B.Sc. GEOGRAPHY LAB MANUAL

4th Semester

Prepared By

Pure & Applied Science Dept.

Geography

MIDNAPORE CITY COLLEGE

MIDNAPORE CITY COLLEGE

DEPARTMENT OF PURE AND APPLIED SCIENCES

GEOGRAPHY LAB MANUAL

B.SC (HONOURS), SEMESTER – IV

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C10P: Environmental Geography Lab

Project File, comprising one exercise each is to be submitted

1. Preparation of questionnaire for perception survey on environmental problems

2. Preparation of check-list for Environmental Impact Assessment of an urban / industrial project

3. Quality assessment of soil using field kit: pH and NPK

4. Interpretation of air quality using CPCB / WBPCB data

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1. Preparation of Questionnaire for Perception Survey on Environmental Problems.

Questionnaire

Questionnaire is a commonly used tool for collecting a variety of data. A questionnaire may include a series of questions pertaining to psychological, social, educational, or any such issues which are sent to an individual or a group, with the aim of obtaining relevant data on the topic of research.

- A questionnaire is a popular means of collecting different kinds of data in research.
- A questionnaire is administered personally either individually or to a group of individuals or is mailed to them to save a great deal of time and money in travel.
- Questionnaires are used both to initiate a formal inquiry and also to supplement and check data previously accumulated.

Types of questionnaires

1. Structured questionnaires

Structured questionnaires are those which pose definite and concrete questions. They are prepared well in advance and not on the spot. The form of questions may require responses which are either closed or open.

- Closed-form of questionnaires is used when categorised data are required. They include a set of questions to which a respondent can reply in a limited number of ways–'yes', 'no', 'no-opinion', or an answer from a short list of possible responses.
- The open-ended responses on the other hand are free and spontaneous expressions by the respondent to the questions posed to him/her. The open-ended responses are used mainly for intensive study of a limited number of cases or preliminary exploration of new problems and situations.

2. Unstructured questionnaires

Unstructured questionnaires are frequently referred to as interview guides. They also aim at precision and contain definite issues that are covered while conducting an interview. Flexibility is the chief advantage of the unstructured questionnaire.

Characteristics of a good questionnaire

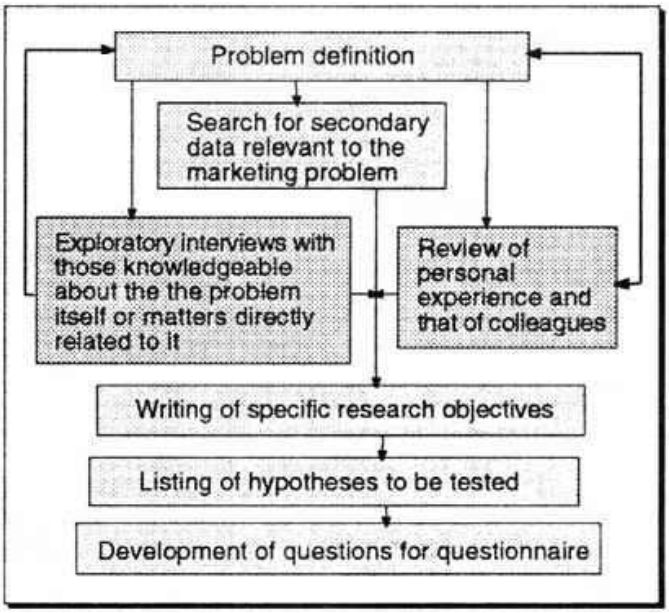
1. **Purpose:** A good questionnaire must serve two purposes. First, it must translate the objectives of an investigation into specific questions. Secondly, the questionnaire must motivate the respondents to communicate the required information.
2. **Language:** The language of a good questionnaire should be concise and directed towards producing uniformity of understanding among the respondents.
3. **Frame of reference:** Questions on controversial issues should be broken down into components, so that the researcher can determine the respondent's feeling about various aspects of the problem.
4. **Arrangement of questions:** The questions placed first in the questionnaire should be the easiest to answer. A proper sequence of questions proceeds from the general to specific, from simple to complex one.
5. **Length of the questionnaire:** A questionnaire should not be longer than necessary. The total number of questions must not be too large to tire or bore the respondents.
6. **Respondents must be competent to answer**
7. **Respondents must be willing to answer**
8. **Clearly typed, i.e. not be hard to read**
9. **Adequate space for answers**
10. **Avoid abbreviations**
11. **Proper instructions**
12. **Questions should be relevant**
13. **Biased terms should be avoided**

No survey can achieve success without a well-designed questionnaire. Unfortunately, questionnaire design has no theoretical base to guide the marketing researcher in developing a flawless questionnaire. All the researcher has to guide him/her is a lengthy list of do's and don'ts born out of the experience of other researchers past and present. Hence, questionnaire design is more of an art than a science.

Preliminary decisions in questionnaire design

There are nine steps involved in the development of a questionnaire:

1. Decide the information required.
2. Define the target respondents.
3. Choose the method(s) of reaching your target respondents.
4. Decide on question content.
5. Develop the question wording.
6. Put questions into a meaningful order and format.
7. Check the length of the questionnaire.
8. Pre-test the questionnaire.
9. Develop the final survey form.



The steps preceding questionnaire design

Steps in questionnaire construction

Questionnaires are constructed in a systematic manner. The process goes through a number of interrelated steps. The most commonly steps are (Sarantakos, 1998):

1. **Preparation:** The researcher thinks of various items to be covered in the questionnaire, arrangement of these items in relation to one another, and taking into consideration questions prepared and used in other similar studies.
2. **Constructing the first draft:** The researcher formulates a number of questions including direct/ indirect, closed/open-ended and primary/secondary/tertiary questions.
3. **Self evaluation:** The researcher thinks about relevance, symmetry, clarity in language, etc.
4. **External evaluation:** The first draft is given to one or two experts/colleagues for scrutiny and suggestions for changes.

5. **Revision:** After receiving suggestions, some questions are eliminated, some changed and some new questions added.
6. **Pre-test or pilot study:** A pre-test or a pilot study is undertaken to check the suitability of the questionnaire as a whole.
7. **Revision:** The minor and major changes may be made on the basis of experience gained in pre-testing.
8. **Second pre-testing:** The revised questionnaire is then subjected to a second test and amended, if necessary.
9. **Preparing final draft:** After editing, checking spelling, space for response, pre-coding, the final draft is prepared.

The cover letter

The cover letter aims at explaining the research topic introducing the objectives of the study, describing how the respondent was selected, giving some important instructions for answering the questions, motivating respondents to participate in the study and assuring anonymity and confidentiality and removing their doubts or mistrust. Here is an example:

> We are surveying students and teachers in selected colleges and university departments for a UGC sponsored programme to find out to what extent the teaching is considered satisfactory, and to ascertain the deficiencies in the existing educational system. Your name was selected at random from the list of students/teachers supplied by the colleges/departments. Our questionnaire will take no more than 20 minutes. Kindly answer all questions.

- The cover letter is thus to contain the following main points: Identifying the researcher and the research sponsor.
- Explaining the social significance of the study.
- Pointing out the main objectives of the study.
- Specifying requirements for completion of questionnaires through brief instructions.
- Giving reasons for respondent's cooperation.
- Assuring anonymity and confidentiality.
- Giving approximate time the questionnaire is likely to take in filling up.

Sample Questionnaire for Perception Survey on Environmental Problems

Questionnaire on Household Waste Management

Surveyed by

Name of the Surveyor
Department of Pure and Applied Sciences
(Geography Unit)
Midnapore City College
Midnapore, West Bengal, India

Date:.....
Time:..... **Location:.....**

This interview is made to you to undertake a research for the partial fulfilment of the award of the degree of BSc (Honours) in Geography. I would like to know about the environmental issues faced at the Household Level in Midnapore town, and about the Solid waste management in that town. Your response will help policy makers to formulate an informed policy about improved water supply service. The interview will take a few minutes and the answers will be completely confidential and strictly for academic purpose. Thus, please answer the questions honestly and as truthfully as you can.

A. Household Details

1. Name of the respondent: .....
2. Are you the head of the household? Yes/No
3. If not, Name of the head of the house hold: .....
4. Total members of the Household .....; Male.....; Female.....; Children (6-14).....; Kids (1- 5 years).....; Infants (12 years).....
5. Education of the Household Head.....
6. Occupation of Head of Household Head.....
7. Average monthly household income.....

B. Household Waste Generation and Disposal

8. In your opinion which of these is a priority concern about waste in the area (tick only)?

1. Littering and looks bad; 2. Effect on human health; 3. Effect on environment; 4. Others.....

9. What do you store your household rubbish in? (For each storage method write down the number of each used in a week.)

	No. /Days
1. Plastic bags	.....
2. Cardboard boxes	.....
3. Rubbish bin/ drum	.....
4. Others	.....
5. No storage—direct disposal to dump	

10. Where do you dispose your generated waste?

1. Nearby container; 2. Open spaces; 3. Near home; 4. Others—Specify .....

11. Can you roughly identify percentage composition of your generated waste?

1. Kitchen waste..... %; 2. Plastic ..... %; 3. Paper .....%; 4. Solids .....%; 5. Others ..... %

16. Do you separate different type of waste at your home? Yes/No
17. Would you do so if you are told by your collection service provider? Yes/No
18. Are there any large bins in your area? Yes/No

C. Garbage Collection Services

19. Do you have regular garbage collection in your area? Yes/No
20. If yes, do you use it? Yes/No; Yes/No
21. How often do you use the collection service? 1. Once a week 2. Other—specify.....
22. Which collection service do you use? 1. Public, 2. Private, 3. Other—specify.....
23. How much do they charge per month? Rs: ..... per month
24. Are you satisfied with your current waste collection service? Yes/No
25. What is the main reason for your level of satisfaction/dissatisfaction?

1. Costs 2. Unreliability 3. Improper collection 4. Reliable 5. Cooperative 6. Others .....

26. Do you separate different type of waste at your home? Yes/No
27. Would you do so if you are told by your collection service provider? Yes/No
28. Do people dump their waste alongside the garbage bins instead of putting it inside those? Yes/No
29. If Yes, Why, in your opinion, people behave like this?

1. Difficult to put waste inside the bin due to height of the bin
2. Difficult to put waste inside the bin due to waste and litter spread around the bin
3. Stray animals (dogs, mouse and birds etc.)
4. Any other reason …….

30. Please identify some of the main problems with the current solid waste management system?

1. Waste lying around, 2. Odor, 3. Rats, 4. Flies, 5. No problem, 6. Others – Specify: …….

31. What is the distance between your house and dumping site? 1. ……. Meters

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D. <u>Miscellaneous</u>

32. How do you evaluate the state of solid waste collection in your house area?

1. Good, 2. Fair, 3. Not Good, 4. Don't Have

33. Please explain why the household solid waste management is important to you?

.....
.....

34. What do you suggest Midnapore Municipality to resolve household solid waste problem?

.....
.....

Thanks for Your Time

2. Preparation of Check-List for Environmental Impact Assessment of an Urban / Industrial Project

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:

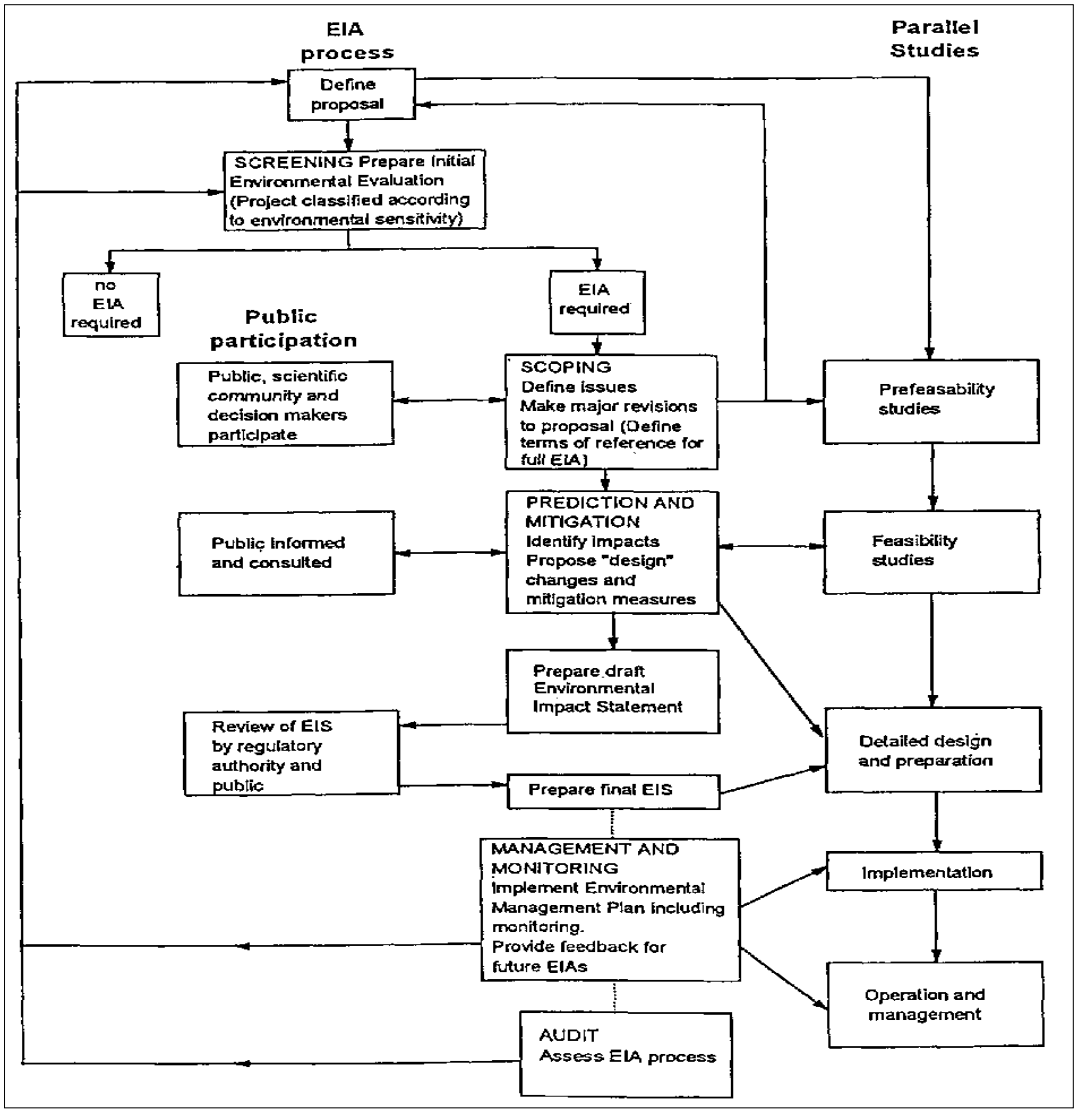
- screening
- scoping
- prediction and mitigation
- management and monitoring
- audit

Figure 1 shows a general flow diagram of the EIA process, how it fits in with parallel technical and economic studies and the role of public participation. In some cases, such as small-scale irrigation schemes, the transition from identification through to detailed design may be rapid and some steps in the EIA procedure may be omitted.

- **Screening** often results in a categorization of the project and from this a decision is made on whether or not a full EIA is to be carried out.

- **Scoping** is the process of determining which are the most critical issues to study and will involve community participation to some degree. It is at this early stage that EIA can most strongly influence the outline proposal.
- **Detailed prediction and mitigation studies** follow scoping and are carried out in parallel with feasibility studies.
- The main output report is called an Environmental Impact Statement, and contains a detailed plan for **managing and monitoring** environmental impacts both during and after implementation.
- Finally, an audit of the EIA process is carried out sometime after implementation. The **audit** serves a useful feedback and learning function.

Flow Diagram of the EIA Process and Parallel Studies



A comprehensive and user-friendly checklist is an invaluable aid for several activities of an EIA, particularly scoping and defining baseline studies. "The ICID Environmental Check-List to Identify Environmental Effects of Irrigation, Drainage and Flood Control Projects" (Mock and Bolton, 1993) is recommended for use in any irrigation and drainage EIA. The Check-list has been prepared for non-specialists and enables much time-consuming work to be carried out in advance of expert input. It includes extensive data collection sheets. The collected data can then be used to answer a series of questions to identify major impacts and to identify shortages of data. A matrix indicates which data are linked to which questions.

Checklists

Checklists are standard lists of the types of impacts associated with a particular type of project. Checklists methods are primarily for organizing information or ensuring that no potential impact is overlooked. They are a more formalized version of ad hoc approaches in that specific areas of impact are listed and instructions are supplied for impact identification and evaluation.

There are four general types of checklists:

1. Simple Checklist: a list of environmental parameters with no guidelines on how they are to be measured and interpreted.

2. Descriptive Checklist: includes an identification of environmental parameters and guidelines on how to measure data on particular parameters.

3. Scaling Checklist: similar to a descriptive checklist, but with additional information on subjective scaling of the parameters.

4. Scaling Weighting Checklist: similar to a scaling checklist, with additional information for the subjective evaluation of each parameter with respect to all the other parameters.

Things to look out for during the preparation of the checklist are-

- It is important to consider the different levels of impact caused by an activity. For example, a change in site run-off can affect the hydrology in the watershed (primary impact); it can also affect the fishes living in the river (secondary impact).
- Certain effects are temporary, while others are long-term. Both form of effects need to be identified and specified.

- Intermittent effects, caused by freak accidents or abnormal natural events should also be considered.
- All of these effects should be viewed individually as well as cumulatively. It is possible that the cumulative effect a collection of impacts can lead to further impacts on the environment.

How is it done?

In preparing a checklist, first, a list of activities is drawn up. Then, the team looks at the possible areas within the project area that will be affected by the activity. This is followed by characterizing the environmental aspects within that area that will be impacted (primary impact). Then, the scope is broadened to include indirect impacts within the area (secondary impacts). The team then considers the indirect impacts of the activity outside the specific area (tertiary impacts). Finally, temporal aspect and cumulative aspects of the activity are taken into the picture.

The checklist is prepared in the form of a table, that looks something like this-

No.	Questions to be considered in Scoping	Yes/No/?	Which Characteristics of the Project Environment could be affected and how?	Is the effect likely to be significant? Why?
1. Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in waterbodies, etc)?				
1.1	Permanent or temporary change in land use, landcover or topography including increases in intensity of land use?			
1.2	Clearance of existing land, vegetation and buildings?			
1.3	Creation of new land uses?			
1.4	Pre-construction investigations eg boreholes, 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 tunnelling?			
1.10	Reclamation works?			

When answered, it looks like this-

3.4	Are there especially vulnerable groups of people who could be affected by the project eg hospital patients, the elderly?	Yes	Project location is adjacent to regional hospital and long term care centre. Potential for significant noise and other disturbance during construction	Yes - Hospital environment may become much noisier over one year construction period.
4. Will the project produce solid wastes during construction or operation or decommissioning?				
4.2	Municipal waste (household and or commercial wastes)?	Yes	New population will generate household and other wastes	No- there is ample local waste management capacity
5. Will the project release pollutants or any hazardous, toxic or noxious substances to air?				
5.5	Dust or odours from handling of materials including construction materials, sewage and waste?	yes	Earth moving during construction could be dusty in dry climate and affect neighbouring habitats and residents	Yes - Habitat is internationally protected and vulnerable to dust deposition. Condition of hospital patients could be worsened by exposure to dust
6. Will the project cause noise and vibration or release of light, heat energy or electromagnetic radiation?				
6.5	From construction or operational traffic?	yes	Heavy traffic flows for import of material during construction affecting residents and hospital	Yes – noise levels already elevated by traffic and industry
7. Will the project lead to risks of contamination of land or water from releases of pollutants onto the ground or into sewers, surface waters, groundwater, coastal wasters or the sea?				
7.2	From discharge of sewage or other effluents (whether treated or untreated) to water or the land?	Yes	Increase in municipal sewage flows from new residents	Possibly – depends on requirement for new treatment facilities

Once a list of all possible impacts and their duration is specified, the team compiles the list into significant and less significant impacts. The significant impacts are given immediate attention during the planning of the activities of the project. Most of the alternatives suggested to the project proponent are based on these impacts.

Example 1: Environmental Checklist

No. of Checklist		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Mining Industry	Thermal Power Station	Hydropower Stations, Dams and Reservoirs	Geothermal Power Station	Other Electric Generation	Power Transmission and Distribution Lines	Roads	Railways	Airports	Ports and Harbors	River and Sand Erosion Control	Bridges	Waste Management	Water Supply	Waste Water Treatment	Agriculture, Irrigation and Livestock Projects	Forestry	Fishery	Other Infrastructure Projects
Class	Items	Industry	Power Generation and Transmission					Infrastructure												
1 Permits and Explanation	(1) EIA and Environmental Permits	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(2) Explanation to the Local Stakeholders	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(3) Examination of Alternatives	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2 Pollution Control	(1) Air Quality	○	○		○	○		○			○		○	○	○			○		○
	(2) Water Quality	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(3) Wastes	○	○	○	○	○		○	○	○	○	○		○	○	○	○	○	○	○
	(4) Soil Contamination					○				○				○		○	○	○		○
	(5) Noise and Vibration	○	○		○	○		○	○	○	○		○	○	○	○			○	○
	(6) Subsidence	○	○		○	○			○	○	○	○			○		○			○
	(7) Odor	○	○		○	○				○	○			○		○	○		○	○
	(8) Sediment										○									
3 Natural Environment	(1) Protected Areas	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(2) Ecosystem	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(3) Hydrology			○		○		○	○	○	○	○	○		○			○	○	○
	(4) Topography and Geology	○		○	○	○	○	○	○	○	○	○	○					○	○	○
	(5) Management of Abandoned Sites													○				○		
4 Social Environment	(1) Resettlement	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(2) Living and Livelihood	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(3) Heritage	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(4) Landscape	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(5) Ethnic Minorities and Indigenous Peoples	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(6) Working Conditions	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
5 Others	(1) Impact during construction	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(2) Accident Prevention Measures	○	○	○	○															
	(3) Monitoring	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

Simple checklist for any Kind of Project

Example 2: Environmental Checklist (Thermal Power Station)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) (b) (c) (d)	(a) (b) (c) (d)
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) (b)	(a) (b)
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a)	(a)
2. Pollution Control	(1) Air Quality	(a) Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), and soot and dust emitted by the power plant operations comply with the country's emission standards? Is there a possibility that air pollutants emitted from the project will cause areas that do not comply with the country's ambient air quality standards? Are any mitigating measures taken? (b) In the case of coal-fired power plants, is there a possibility that fugitive dust from the coal piles, coal handling facilities, and dust from the coal ash disposal sites will cause air pollution? Are adequate measures taken to prevent the air pollution?	(a) (b)	(a) (b)
	(2) Water Quality	(a) Do effluents including thermal effluents from the power plant comply with the country's effluent standards? Is there a possibility that the effluents from the project will cause areas that do not comply with the country's ambient water quality standards or cause any significant temperature rise in the receiving waters? (b) In the case of coal-fired power plants, do leachates from the coal piles and coal ash disposal sites comply with the country's effluent standards? (c) Are adequate measures taken to prevent contamination of surface water, soil, groundwater, and seawater by the effluents?	(a) (b) (c)	(a) (b) (c)
	(3) Wastes	(a) Are wastes, (such as waste oils, and waste chemical agents), coal ash, and by-product gypsum from flue gas desulfurization generated by the power plant operations properly treated and disposed of in accordance with the country's regulations?	(a)	(a)
	(4) Noise and	(a) Do noise and vibrations comply with the country's standards?	(a)	(a)

	Vibration			
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a)	(a)
	(6) Odor	(a) Are there any odor sources? Are adequate odor control measures taken?	(a)	(a)
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a)	(a)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms? (e) Is there a possibility that discharge of thermal effluents, intake of a large volume of cooling water or discharge of leachates will adversely affect the ecosystem of surrounding water areas?	(a) (b) (c) (d) (e)	(a) (b) (c) (d) (e)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a) (b) (c) (d) (e) (f) (g) (h) (i) (j)	(a) (b) (c) (d) (e) (f) (g) (h) (i) (j)
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is sufficient infrastructure (e.g., hospitals, schools, and roads) available for the project implementation? If the existing infrastructure is insufficient, are any plans developed to construct new infrastructure or improve the existing infrastructure? (c) Is there a possibility that large vehicles traffic for transportation of materials, such as raw materials and products will have impacts on traffic in the surrounding areas, impede the movement	(a) (b) (c)	(a) (b) (c)

		of inhabitants, and any cause risks to pedestrians? (d) Is there a possibility that diseases, including infectious diseases, such as HIV, will be brought due to the immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (e) Is there a possibility that the amount of water used (e.g., surface water, groundwater) and discharge of thermal effluents by the project will adversely affect existing water uses and uses of water areas (especially fishery)?	(d) (e)	(d) (e)
	(3) Heritage	(a) Is there a possibility that the project will damage the local archaeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a)	(a)
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)	(a)
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) (b)	(a) (b)
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) (b) (c) (d)	(a) (b) (c) (d)
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce the impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce the impacts?	(a) (b) (c)	(a) (b) (c)
	(2) Accident Prevention Measures	(a) In the case of coal-fired power plants, are adequate measures planned to prevent spontaneous combustion at the coal piles (e.g., sprinkler systems)?	(a)	(a)
	(3) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) (b) (c) (d)	(a) (b) (c) (d)

6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of electric transmission lines and/or electric distribution facilities). (b) Where necessary, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including construction of port and harbor facilities).	(a) (b)	(a) (b)
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, and global warming).	(a)	(a)

1) Regarding the term “Country's Standards” mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are requested to be made. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

However, checklists may not be the best way to go about impact prediction. Checklists, though the simplest, have a lot of disadvantages associated with its use. First of all, the list prepared is very long. The checklist alone runs into multiple pages. Further, it is very subjective. One EIA team could consider an impact significant, while another might not. Within the same team, there may be disagreements. The checklist is also very confusing, when you take the primary, secondary, tertiary impacts as well as the temporal aspect of the impact. Compilation will also take much longer.

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3. Quality Assessment of Soil Using Field Kit: pH and NPK

Determination of Soil pH

One of the most enlightening attributes of a soil is its pH. Whether a soil is acidic or basic has much to do with the solubility of various components the relative bonding of ions on exchanges sites and activity of various microorganisms. The plant nutrient is 6.5 to 7.5. Thomas (1957) noted that the three-soil pH availability is influenced by soil pH. The ideal pH range for availability of nutrients is 6.5 to 7.5. Thomas (1957) noted that three soil pH ranges are particularly informative pH less than 4 indicates the presence of free acid generally from association of sulphides: a pH below 5.5 suggests the likely occurrence of exchangeable Al and pH from 7.8 to 8.2 indicates the presence of CaCO3.

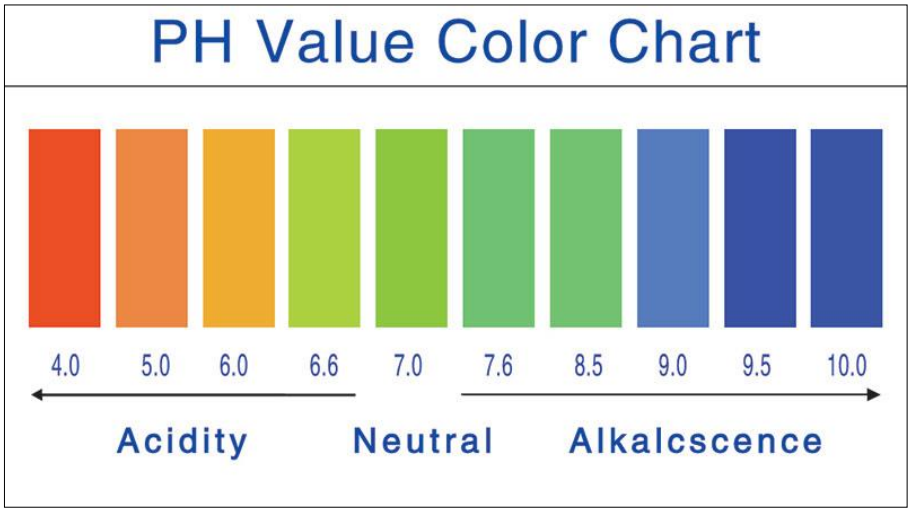
Requirements:

A. Well organized Soil Kit Box
B. Mark Test Tube
C. Test Tube stand
D. Rubber strap
E. Soil Sample.

Procedure:

I. Take a clear test tube and pour distilled water up to 5 ml mark.
II. Put 2 gm. Of soil to the test tube with the scoop provided.
III. Add 0.5 gm. (1 spoonful) of barium sulphate from container no. 3.
IV. Allow the test tube to stand for 20 minutes with occasional shaking.
V. Add 5 drops of indicator no. 1 from container no. 1 to the above solution close the mouth of the tube with a clean rubber stopper and shake the contents thoroughly. Allow the soil to settle down completely.
VI. Compare the colour of the upper liquid in the test tube with the colour chart no. 1 and find out the nearest match. The match colour will indicate soil pH.

VII. If the colour of the upper liquid in the test tube indicates pH near 6 then repeat the whole experiment using indicator no. 2 instead of indicator no. 1 and match the colour of the upper liquid with colours of the chart no. 2.



Determination of Nitrogen (N):

Nitrogen is macro elements for plants. Plants require more nitrogen (N) than any other nutrient but only a small portion of the nitrogen in soil is available to plants; 98 % of the nitrogen in soil is in organic forms. Soil microorganisms convert organic forms of nitrogen to mineral forms when they decompose organic matter and fresh plant residues.

Nitrogen is really important for plant growth (structure), plant food processing (metabolism), and the creation of chlorophyll. Without enough nitrogen in the plant, the plant cannot grow taller, or produce enough food (usually yellow).

Requirements

A. Well organised Soil Kit Box
B. Mark Test Tube
C. Test Tube stand
D. Rubber strap
E. Soil Sample.

Procedure

I. Take a clear test tube and fill it with distilled water up to 10 ml mark.

II. Add to it 2 gms. of soil sample with the scoop provided and close the test tube with a clean stopper.

III. Shake thoroughly for 5 minutes and filter it.

(For Nitrate Nitrogen)

IV. Transfer 1 drops of the filtrate solution from step 3 to a clean 2 inch test tube and carefully add 8 drops of solution from container no. 13. v. Compare the solution's colour with the colour chart no. 5.

(For Ammoniacal Nitrogen)

iv. Transfer 3 drops of filtrate from step 3 to another clean 2inch test tube and add1 drop of solution from container no. 14.

v. Compare the solution colour with the colour chart no. 16.

Determination of Phosphorus (P)

Phosphorus is an essential macro-element, required for plant nutrition. It participates in metabolic processes such as photosynthesis, energy transfer and synthesis and breakdown of carbohydrates.

Phosphorus is found in the soil in organic compounds and in minerals. Major organic sources of phosphorus include, again, certain manures, as well as bone meal and pulverized rock phosphate. Rock phosphate is a phosphorus-rich rock that is ground into fine particles that release their phosphorus slowly and over the course of many years.

Requirements:

A. Well organized Soil Kit Box
B. Mark Test Tube
C. Test Tube stand
D. Rubber strap
E. Soil Sample
F. Funnel

Procedure:

I. Take a clean test tube.

II. Pour solution from container no. 4 in the test tube up to 10ml mark.

III. Add a pinch of darco from container no. 5 to the above test tube.
IV. Add to above 5 gm. of soil with the scoop.
V. Close the test tube mouth with the clean rubber stopper. Shake the contents thoroughly for 3 minutes and filter the solution.
VI. Take the filtered solution up to 2 ml mark in another test tube.
VII. Pour 2mlof solution from container no. 6 in the above test tube containing filtered solutions.
VIII. Wash the inner side of test tube with about 2ml of distilled water from the wash bottle. Keep it, this will be requiring at step no. 11.
IX. Take 66 ml of distilled water in a 100ml beaker.
X. Add to the beaker containing water 0.5 ml. of the solution from container no. 7.
XI. Take 1 ml. of this solution from the beaker and add it to the solution at step no. 8.
XII. Shake the contents thoroughly after closing the tube mouth with a rubber stopper.
XIII. Add distilled water up to 10 ml. mark in the above test tube.
XIV. Compare the colour of the solution with colour chart no. 3.

Determination of Potassium (K)

Potassium's unique function is as a regulator of metabolic activities. It is the only nutrient which remains in the plant fluids in a soluble state. In some plants, more is required than any other soil nutrient. Potassium is highly mobile in the soil, but leaching is minimized by cation exchange and by trapping within clay crystals. Potassium is the Great Regulator. It is active in numerous enzyme systems which control metabolic reactions, particularly in the synthesis of proteins and starches. Micronutrients, which have similar functions, are required only in minute amounts. In contrast, potassium must be present in large quantities, although it seems to be completely unsuited for its role.

Requirements:

A. Well organized Soil Kit Box
B. Mark Test Tube
C. Test Tube stand
D. Rubber strap
E. Soil Sample
F. Funnel

Procedure:

I. Take a clean test tube.

II. Pour in it solution from container no. 10 up to 10 ml mark.

III. Add 5 gms. of soil with the scoop to the above solution.

IV. Shake the solution for one minute closing the test tube mouth by rubber stopper and then filter. Keep the filtrate for use at step no. 8.

V. Take another clean test tube. vi. Pour solution from container no. 11 up to 2 ml mark.

VI. Add 6 drops of solution from container no. 12 to the above solution without touching the side of the test tube.

VII. Take 2 ml. of the solution from step no. 4 in syringe.

VIII. Inject the solution from the syringe with force into the other solution at step no. 7. Turbidity will develop in the solution after 5 minutes.

IX. Compare the turbidity with the colour chart no. 4.

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4. Interpretation of Air Quality Using CPCB / WBPCB Data

Under the National Ambient Air Quality (NAQM) Monitoring program, air quality in the city of Cochin is being regularly monitored by Central Pollution Control Board. Air quality management programme requires reliable information of air quality collected, evaluated and analysed regularly. This is of paramount importance in protecting man and his environment from damaging exposure to air pollution. The data for SPM, SO_2 and NO_x were collected at three sites representing residential, commercial and industrial activity zones at all the sites. Based on this data, the Air Quality Index (AQI) was calculated using Oak Ridge Air Quality Index (ORAQI). This is an indication of the total effect of all the pollutants together. Calculations of AQI for different seasons and different activity zones are done to examine the pollution level.

Calculating AQI (Air Quality Index)

Since it was launched in 2015, the Air Quality Index (AQI) has been widely used in reporting and discussing air quality in India. The AQI was created to help communicate the severity of air quality levels for multiple pollutants to the public, the risks they carry and recommended defensive measures through a single composite index, a colour-code and broad categories of air quality levels (good, moderate, poor, etc.).

To determine air quality in an area, pollutant concentrations are physically measured and reported. The AQI is calculated based on the average concentration of a particular pollutant measured over a standard time interval (24 hours for most pollutants, 8 hours for carbon monoxide and ozone). For example, the AQI for PM2.5 is based on 24-hour average concentration and computed as shown in the table below.

Category	AQI (no units)	24-hour average PM 2.5 concentration (microgram/m^3)
Good	0-50	0-30
Satisfactory	51-100	30-60
Moderate	101-200	60-90
Poor	201-300	90-120
Very poor	301-400	120-250
Severe	401-500	250-380

As the table shows, the AQI for PM2.5 is in the 'good' category (0-50) if the 24-hour average is within 0-30 microgram/m^3; e.g. if the 24-hour average concentration is 15 microgram/m^3, the corresponding AQI is 25.

It is severe (400+) if 24-hour averages are greater than 250 microgram/m^3, and if concentrations are 380 microgram/m^3 or more, they get reported as 500, the maximum possible.

In a similar manner, the AQI is calculated separately for each of several pollutants.

In India, AQI calculations include the eight pollutants for which National Ambient Air Quality Standards (NAAQS) have been set. These are PM10, PM2.5, nitrogen dioxide, sulphur dioxide, carbon monoxide, ground-level ozone, ammonia, and lead.

However, all of the pollutants are not measured at every location.

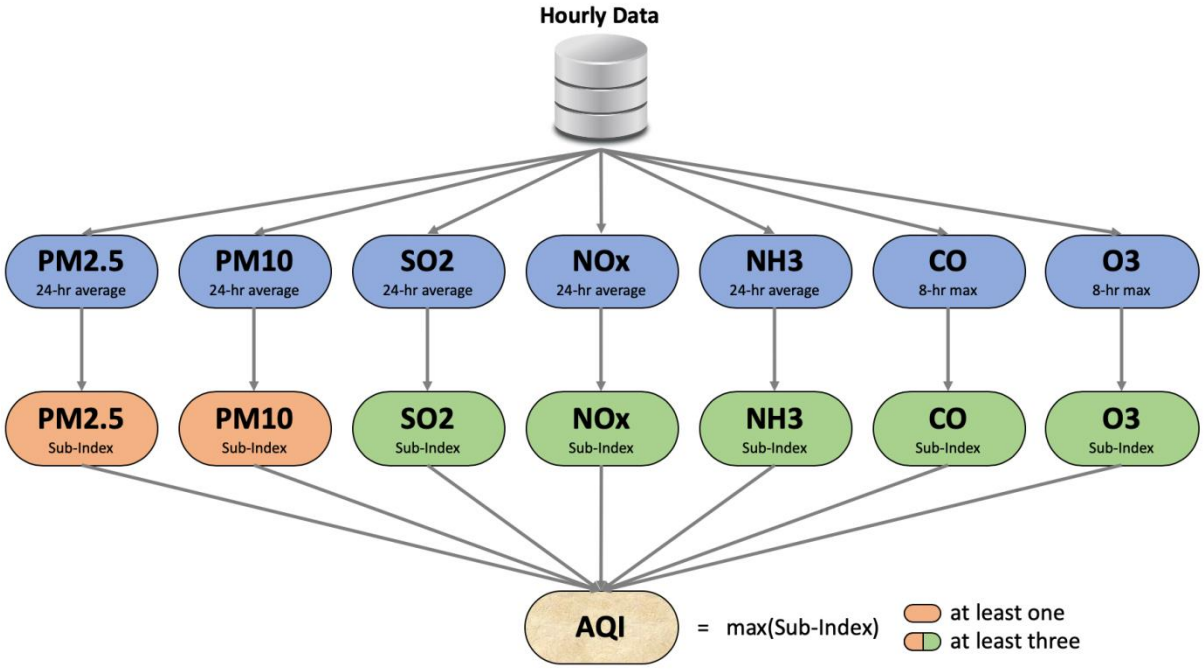
The final AQI is equal to the highest of the AQI values calculated separately for each pollutant, and the corresponding pollutant is also reported.

For example, if the individual pollutant index for PM2.5 is 90, nitrogen dioxide is 45 and ozone is 65, then the AQI will be 90, the value of the index for PM2.5.

If a city has multiple monitors, the average across the city is used and reported in CPCB's AQI bulletin (see figure below).

S.No	City	Air Quality	Index Value	Prominent Pollutant	Based on Number of Monitoring Stations
13	Bathinda	Moderate	117	PM_{10}	1
14	Bengaluru	Satisfactory	90	$PM_{2.5}$, PM_{10}	8
15	Bhiwadi	Poor	235	$PM_{2.5}$	1
16	Bhiwani	Moderate	192	$PM_{2.5}$	1
17	Bhopal	Poor	222	$PM_{2.5}$	1
18	Brajrajnagar	Satisfactory	95	PM_{10}	1
19	Chandigarh	Moderate	109	$PM_{2.5}$	1
20	Chennai	Poor	234	$PM_{2.5}$, PM_{10}	3
21	Chikkaballapur	Satisfactory	88	$PM_{2.5}$	1
22	Delhi	Very Poor	321	$PM_{2.5}$	33
23	Dharuhera	Poor	259	$PM_{2.5}$	1
24	Eloor	Good	32	CO	1

Formula



- The AQI calculation uses 7 measures: PM2.5, PM10, SO2, NOx, NH3, CO and O3.
- For PM2.5, PM10, SO2, NOx and NH3 the average value in last 24-hrs is used with the condition of having at least 16 values.
- For CO and O3 the maximum value in last 8-hrs is used.
- Each measure is converted into a Sub-Index based on pre-defined groups.
- Sometimes measures are not available due to lack of measuring or lack of required data points.
- Final AQI is the maximum Sub-Index with the condition that at least one of PM2.5 and PM10 should be available and at least three out of the seven should be available.

Example 1: Interpretation of Air Quality Data

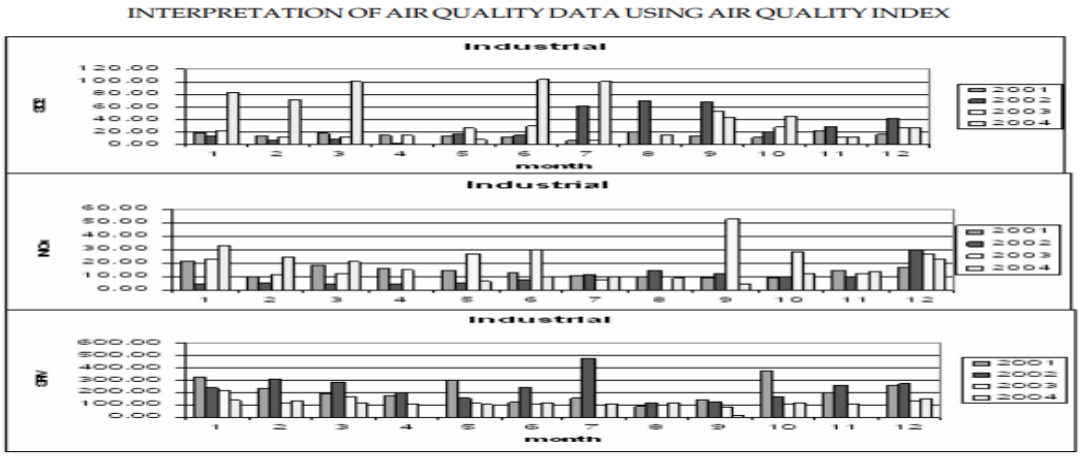


Fig. 1 Concentration of SO_2, NOx & SPM for industrial area

Interpretation

A comparison of the concentration of SO_2, NO_x and SPM for the years 2001-2004 is done. For this monthly mean data of pollutants for industrial, commercial and residential zones for the years 2001-2004 are utilized.

Figure1 shows the mean values plotted for industrial area. It is seen that in 2004 most of the months show very high values of SO_2 concentration, of the order of 100µg/m^3, even though within limits. In 2003 a few months show >60µg/m^3. NOx shows comparatively lower values of the order of <30µg/m^3 with single variation between years. But abnormal values can occur due to sudden increase in the NOx level. Except for a few months 2004 doesn't show an increase. SPM levels are much reduced than previous years, which can be due to the effect of control measures taken.

For industrial area AQI varies between Good and Fair categories. And there are occasions of excellent category also. It doesn't show a decreasing trend of air quality, but a few months show high values in 2004.

Exercise 2: Carefully read the following table and interpret it.

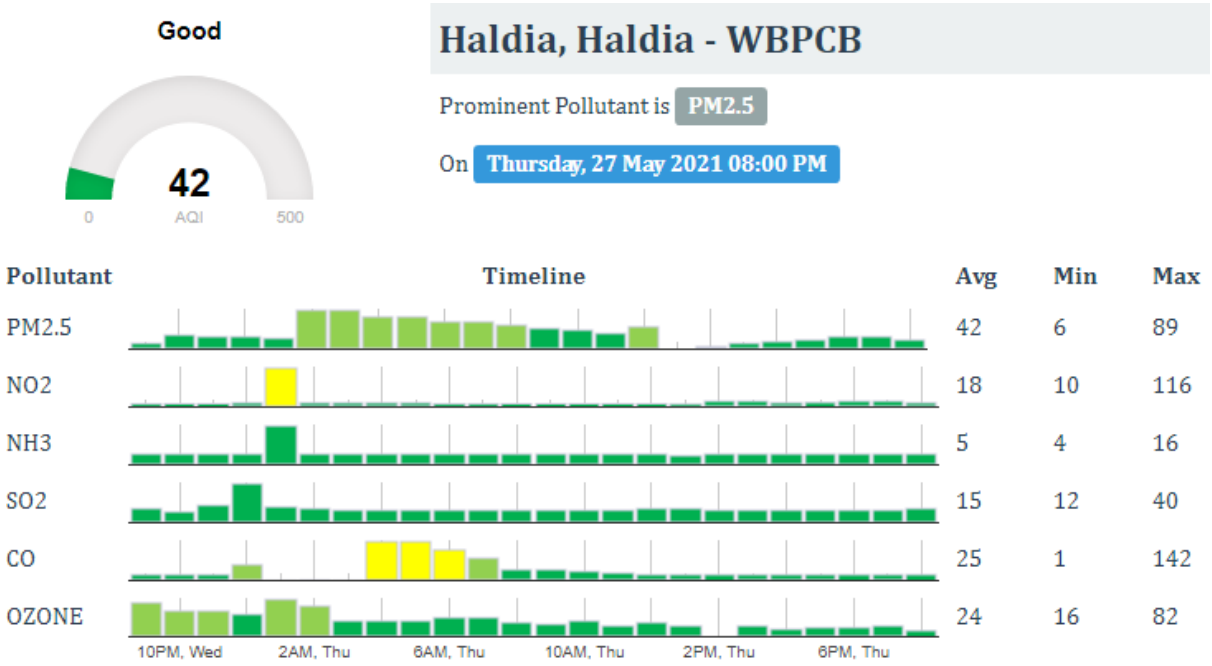
Monthly Average Concentrations of Ambient Air Quality in Kolkata, 2010-2011

Sl. No.	Months	Monthly Average Concentration (µg/m^3)			
		SO_2	NO_2	RPM	SPM
1	10 April	7.6	50.2	45	117
2	10 May	5.4	42.3	35	96
3	10 June	5.0	43.8	34	90
4	10 July	4.4	39	28	77
5	10 August	4.2	38.3	28	75
6	10 September	4.4	37.1	34	88
7	10 October	6.1	49.3	63	155
8	10 November	7.9	65.8	127	265
9	10 December	9.9	78.9	179	342
10	11 January	9.2	94	211	-
11	11 February	8.2	79.7	172	-
12	11 March	5.5	59.7	96	-

Note: (NAAQS: SO_2–80 µg/m^3; NO_2–80 µg/m^3; RPM–100 µg/m^3; SPM–No Standard).

Source: WBPCB

Exercise 2: Carefully read and interpret the following diagram regarding the air quality condition of Haldia and identify the impact of air quality on human health.



AQI	Remark	Color Code	Air Quality Index (AQI) Possible Health Impacts
0-50	Good		Minimal Impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to the people with lung, heart disease, children and older adults
201-300	Poor		Breathing discomfort to people on prolonged exposure
301-400	Very Poor		Respiratory illness to the people on prolonged exposure
>400	Severe		Respiratory effects even on healthy people

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This self-learning material is based on different books, journals and web sources.