Environmental Impact Assessment of Construction Activity on Air Quality

A Dissertation

Submitted in partial fulfillment of the

requirement for the award of degree of

Masters in Technology

In

Environmental Science and Technology

Submitted by

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Under the Guidance of

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SCHOOL OF ENERGY AND ENVIRONMENT
THAPAR UNIVERSITY, PATIALA
(Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956)

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that Ms. Nitti Goyal had been associated with our organization as an Intern from 15th June 2017 till 14th June 2018.

She was working at the Gurgaon office of our organization and her major duties included preparation for EC Application for 8(a) & 8 (b) Project and Preparation of EIA Reports of various Construction/Infrastructure development Projects.

Her exposure in these areas has been great. During her tenure with the organization, she has shown a considerable growth being a valuable resource. Moreover, she proactively handled the major responsibilities related to her work.

We take this opportunity to thank her for her contribution and wish her success in all future endeavors.

For Vardan EnviroNet

VARDAN ENVIRONET D 142 Sushant Lok-III GURGAON

Anshul Yadav
General Manager

Date: 14.06.2018
Place: Gurgaon

DECLARATION CUM CERTIFICATE

I hereby declare that the project work entitled 'Environmental Impact Assessment of construction activity on Air quality' is an authentic record of my own work carried out at Vardan EnviroNet as requirement of one year project internship for the award of degree of M. Tech (Environmental Science and Technology), Thapar University, Patiala, under the guidance of Aman Sharma and K.S. Babu, during June 15, 2017 to June 14, 2018.

Goyal

(Signature of student)
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Date: 14/06/2018

Certified that the above statement made by the student is correct to the best of our knowledge and belief

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Today, I am want to express my deep and sincere thanks to ***Dr. K.S.Babu*** *Assistant Professor of Department of Environmental Science & technology, Thapar University of Patiala, for giving me chance to work with him.*

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I am also thankful to my all my family members especially my parents, brother & sister whose constant support and help was always available during the completion of this study.

Last but not the least I am thankful to the almighty God and my spiritual gurus who inspire me to do something useful for protection of this beautiful blue planet of ours. This study is my humble attempt to do so and dedicated to this noble cause.

NITTI GOYAL

ABSTRACT

In order to study whether its beneficial or harmful effect, evaluation of any project through EIA has become must. Indian construction industry is rapidly growing at a rate of 9.2% whereas in world it is at an average of 5.5%. Undertaking EIA for construction industry can improve site management and can reduce environmental impacts both on and off site. In order to appreciate the risks posed by construction activities and taking steps to reduce incidents can help reduce costs and other effects. The report includes the various steps involved in EIA, environmental effects of construction industry and EIA with relation to construction industry. It further includes the air quality index (AQI) and cumulative ground level concentration of project site using Aermod as dispersion modeling software.

Keywords: EIA, construction, environmental impact, environment clearance, air quality index (AQI), AERMOD, Ground level concentration

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ABBREVIATIONS	
AAQM	Ambient Air Quality Monitoring
CPCB	Central Pollution Control Board
DG	Diesel Generator
E	East
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ENE	East of North- East
EPA	Environmental Protection Agencies
ESE	East of South East
GIS	Geographical information system
GLC	Ground level concentration
IMD	Indian Meteorological Department
KLD	Kilo Litre Per Day
KVA	Kilo Volt Ampere
KW	Kilo Watt
MoEF&CC	Ministry of Environment, Forest and Climate Change
NH	National Highway
NNE	North of North-East
NNW	North of North-West
NO_2	Nitrogen Dioxides
Pvt.	Private
QC	Quality Council
QCI	Quality Council of India

CHAPTER-1

INTRODUCTION

In India, there are many ongoing activities which contribute in its growth and development as river valley projects, industries, construction activities, highways and airports developments etc. These activities contribute to nation's advancement on the contrary these activities have adverse impacts on environment which can't be ignored completely. These activities contribute majorly in pollution and degradation of natural resources.

Concentrating on construction industry, with its raw material supplying industries which support it is the major exploiter of natural resources in every aspect. As per study conducted by World Resources Institute, world has reached a critical stage in respect to degradation of loss of biodiversity, forests and increase in greenhouse gases (GHS) in atmosphere, which result in change of climatic conditions and effect on human health. (Spence et.al 1993)

The construction industry, considered to be crucial in terms of housing, road and transport infrastructure, is of high economic significance but has severe environmental, economical and social consequences. (Burgan et.al 2006) These impacts need to be predicted at an early stage, so its effects can be minimized.

EIA was the step towards this problem. EIA is a tool which is used to evaluate short term and long term impacts of respective project both positive and negative. Impacts will be accounted for complete life cycle (Land acquisition, site setting, construction activity, project in operation phase) to make it more effective and how they can affect environment have been entailed in details in further sections.

Complete life cycle of project or building includes three stages i.e.

- Pre-construction
- During construction
- Post-construction

Analyzing the process in all stages provides a clear and better understanding of construction, operation, building design and affect on environment and human. By studying each stage we can provide the alternatives for sustainable development in construction activity.

Pre-construction phase is mainly about planning and gathering of resources which is very first step in this process and most important also. It includes site selection, appropriate design taking into consideration the environment part of view. Energy and cost efficient raw material should be used. During construction phase, that is when project is in construction phase, maintenance and operation are very crucial. We should minimize site impacts by proper planning. Excavation of soil should not make any changes to drainage system or flow of water. Waste management is of at most important as construction & demotion waste generated from project site can be intoxicated and bulk of waste can also damage environment and human. Once project is in operation phase i.e. post construction most important thing is to incorporating the norms laid during previous phases. Proper management of solid waste, zero discharge of untreated water and follow the environment management plan in every aspect. (Sev 2009)

1.1 ENVIRONMENTAL IMPACT ASSESSMENT:

First EIA was laid in 1976-77, mainly for river valley projects because Planning Commission of India asked to Department of Science and Technology (DST) to analyze all river valley projects from environmental point of view, but this doesn't have legislative support so to fill this gap Environmental Protection Act, 23 May, 1986 was enacted.

On 27 January 1994, the Union Ministry of Environment and Forest (MoEF) Government of India, under the Environmental Act , 1986 made EIA statutory .With this Act, EIA notification was promulgated and Environmental Clearance (EC) was made compulsory for all new and expansion activities which are listed in Schedule 1 of notification and was made mandatory for 32 categories of developmental projects which includes Building and Township development projects, river valley projects, cement plants, Common Effluent treatment plan , Sugar, steel , distillery industries and many others. But due to many shortcomings EIA notification was incapable to decentralize its power between State and Central Government. Over the period, certain bottle necks and drawbacks were observed in smooth implementation of the Notification. After consulting with every stake holders over a period of one year, a draft notification of

environmental clearance process was published on September 15, 2005. After due consideration of all the suggestions received, the Ministry notified the final Notification on September 14, 2006 superseding the EIA Notification 1994. (chapter-2, history and evaluation of EIA, 2004)

With the notification of Environmental Impact Assessment 2006, environmental clearance process has been re-engineered. The important improvements, changes include introduction of screening and scoping of the project proposals for the identification of the actual environmental priorities without asking for irrelevant and time- consuming studies. The projects will require prior environmental clearance based on the impact potential of project instead of cost criteria. Public Hearing proceedings are also better structured and time bound.

EIA notification 1994 was based on cost of project where as EIA notification 2006 focus on size and capacity of projects. EIA notification 2006 categorize projects in Category A & B (B1 & B2) set time limits on all stages and further it also involves public consultation, which was very important. From last 12 years, Environmental impact assessment (EIA) has a major role to play from evaluating the positive and adverse impacts of a concerned project.

The project resolves around “Environmental impact assessment of construction projects” and its impact (majorly air) on nature and possible mitigation measures. Usually this entire process is done before the start of construction activity which gives idea to the government officials and developers that whether the project should setup or not and what are its impact in short term and long term on environment and society.

The dissertation work starts with why EIA is necessary and what are the impacts of construction activity on air. Air Quality index (AQI) is also discussed and calculated as per CPCB norms taking into consideration construction activity going in Gurugram i.e. Expansion of IT park at village – Medawas, Sector-62, Gurugram, Haryana by M/s Baakir Real Estate Pvt Ltd, air dispersion modeling was done by using AERMOD dispersion model for predicting the cumulative ground level concentration from proposed project.

Impacts of above said project are analyzed with the help of checklist method in detail in this report and then emphasize on mitigation measures to reduce air pollution.

1.2 WHAT IS ENVIRONMENTAL IMPACT ASSESSMENT (EIA):

EIA is a methodology used to predict impacts either beneficial or adverse at an early stage before taking up any project. It analyze the environmental impacts considering all possible aspects i.e. socio-economic, human health, environmental degradation, potential impacts and cultural. EIA is used at the planning stage of any activity. With the help of EIA, proponent can find ways to mitigate the negative impacts and can go for sustainable development.

1.3 FOR WHICH PROJECTS ENVIRONMENTAL CLEARANCE (EC) IS REQUIRED:

As per EIA notification 2006, following projects need prior clearance from the concerned authority, for Category A project clearance will be granted by Expert appraisal committee by MoEFCC and in case of Category B project clearance will be granted by respective SEIAA authority.

i. All new projects or activities listed in the Schedule to this notification;
ii. Expansion cum modernization of existing projects or increase in capacity of production
iii. Any change in product - mix in an existing manufacturing unit. (EIA notification, 2006)

1.4 WHY EIA IS NECESSARY:

Environmental degradation in terms of air, water, soil, noise and the depletion of natural resources by anthropogenic activities or sources have been major concern in the last decades. Due to these growing concerns planning authorizes need to keep check on activities proposed and their environmental consequences. Keeping in mind the trends of Sustainable Development, it has been seen that all developmental efforts need to be coordinated with conservation of natural resources, environment, sociology and ecology.

With this in view, the Ministry has drafted various policies and legislations for the protection and conservation of environment. It has been experienced that Environmental Impact Assessment (EIA) is an important management tool for integrating environmental concerns in development process and for improved decision making.

EIA is the most beneficial tool used to full fill this need. EIA process includes first identification of impacts from proposed activity and then evaluating and preparing mitigation measures for these impacts. The objective of EIA is to minimize environmental problems from any activity

proposed.

1.5 STAGES IN THE PRIOR ENVIRONMENTAL CLEARANCE (EC) PROCESS FOR NEW PROJECTS:-

There are maximum of four stages in environmental clearance process of any undertaking project or activity. These stages are given in given below in their sequential order (EIA notification, 2006):

- Stage (1) Screening (Only for Category 'B' projects and activities)
- Stage (2) Scoping
- Stage (3) Public Consultation
- Stage (4) Appraisal

1.6 AIR QUALITY INDEX (AQI):

1.6.1 *What is AQI* :

An air quality index is a derived single number from weighed values of multiple results of criteria pollutants. This is derived from numerical manipulation by using sub indices to one simple form so that it can be easily understood. ("Air Quality Index (AQI) Basics", 2018)

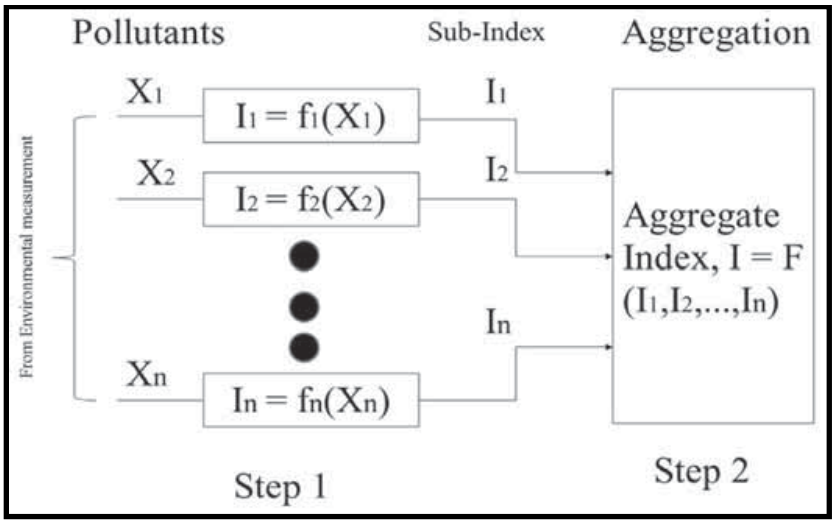


Figure1.1: Formation for an aggregated air quality index

(Source: http://www.indiaenvironmentportal.org.in/files/file/Air%20Quality%20Index.pdf)

AQI is calculated in 2 steps, one is to calculate sub-indices and then aggregating sub-indices formed in simple weighed form. Maximum value from aggregating functions is said to be AQI of that particular location.

1.6.2 *AQI is used for:*

It is very important for the citizens, to known about air pollution level on daily basis especially for those who suffer from illnesses caused by exposure to air. Thus, a simple yet effective communication of air quality is important. AQI is a number used to tell public how clean or polluted the air is. By knowing the value of AQI we can predict its impact on human health. The concept of an air quality index (AQI) that transforms weighted values of individual air pollution related parameters (e.g. SO2, CO, visibility, etc.) into a single number or set of numbers is widely used for air quality communication and decision making in many countries. AQI has set of defined range by CPCB, which has 6 categories according to effect on human health that is Good, Moderate, Unhealthy for sensitive group, Unhealthy, very unhealthy. For these categories every country has different air quality indices and standards. Briefly, an AQI is useful for:

(i) General public to know air quality in a simplified way and associated health impacts of air pollution exposure

(ii) A decision maker to know the trend of events and to chalk out corrective pollution control strategies

(iii) A government official to study the impact of regulatory actions

(iv) A scientist who engage in scientific research using air quality data.

(v) Rank cities/towns for prioritizing actions based on measure of AQI

AQI Categories and Range

Good (0-50)	Satisfactory (51-100)	Moderate (101-200)	Poor (201-300)	Very poor (301-400)	Severe (> 401)

[Colour, Category, AQI Number]

Air Quality Index Categories and its effect:

- 0-50 – “Good” AQI, which means air quality is satisfactory and has no negative effect on human health.
- 51-100- “Satisfactory” AQI which means air has negligible effect on human health
- 101-200- “Moderate” which means air quality has unhealthy effect but only on sensitive group of people and people having lung diseases (Children, old age group)
- 201-300-“Poor” , it indicates that air quality has unhealthy effect on all age groups resulting in respiratory and cardiac problems
- 301-400-“Very poor” this indicates very serious effect on human health which can result in major heart and lung diseases
- >401- “Severe” which means air quality threatening and can have hazardous effect on human health

In further given chapters calculation and results of AQI are given.

1.7 AERMOD:

1.7.1 *What is AERMOD*?

Air dispersion modeling is an approach to predict ground level concentration or dispersions of any pollutants. It is used to predict spatial and temporal variations of pollutants and the change in behavior of pollutants considering mathematical algorithms.

AERMOD is one of the air dispersion models by Lakes & Environment which is used for short-range (up to 50 Km) dispersion. Aermod takes into consideration the metrological factors which influence the dispersion of pollutant to a great extent. Mixing height, wind speed, wind direction and other parameters are provided as input to the software. AERMET is the metrological preprocessor of Aermod which is first step of air modeling.

Dispersion of pollutants depends on many parameters i.e. metrological conditions, plume rise, baseline concentration, and Elevation height and emission rate of source. Source can be point, line and area in nature. Here study period is of post monsoon i.e. October to December. Dispersion of pollutant is maximum in summer season due to high mixing height but in winter season mixing height is least and respectively pollutants did not get dispersed into atmosphere

rather scatter near the atmosphere which is the worst case scenario and it has bad effect on human health. In monsoon season pollutants get scavenged by the process of wet deposition method and results in minimum concentration of pollutants. Here in this report various sources used, their emission rate and steps involved in Aermod processing is discussed. Here, AERMOD is used to find out the cumulative ground level concentration (GLC) of critical pollutants (SPM, Sox, NO_2, CO). Baseline concentrations of pollutants are manually monitored at project site and the 7 nearby locations in 10 km study area.

1.8 OBJECTIVES OF STUDY:

1. To understand the environment clearance process of building and construction activities.
2. To identify the drawback of EIA report and opportunities to make it effective.
3. Identifying and analysis potential impacts of project to minimize its effects
4. To study the existing scenario of air for project area
5. To predict cumulative ground level concentration (baseline + incremental) of criteria pollutants which induces during construction activities.

CHAPTER-2

LITERATURE REVIEW

2.1 ENVIRONMENTAL CLEARANCE PROCESS FOR CONSTRUCTION ACTIVITIES:-

The objective of the EIA Notification, 2006 is to set procedures of environmental clearance before establishment of identified nature and size. For clearance of any proposed project the applicant will have to furnish, Form 1 and the supplementary Form 1A, a copy of the conceptual plan along with application and required annexure.

As per EIA notification, 2006 all activities or project are categorized with some general and specific condition. Construction and building project comes under item 8 which is further categorized on the basis of built up area.

The details of the categories of Building and Construction projects are mentioned in the given schedule are as follows:

Table 2.1: Categorization of project

Project or Activity Category		Category with threshold limit B category	General conditions
8.	Building/ Construction projects / Area Development projects and Township		
8(a)	Building and Construction projects	>20000 sq.mt and <1,50,000 sq.mt of built-up area#	Following are the condition to consider any activity of category B to Category : i) Protected areas notified under the wildlife (Protection) Act,1972 ii) Critically polluted areas as identified by the Central Pollution

			Control Board from time to time iii) Eco sensitive areas as notified iv) Inter -state boundaries and International boundaries.
8(b)	Township and Area Development projects	Covering an area >50 ha and or built up area 1,50,000 sq .mtrs ++	
All projects under item 8(b) shall be appraised as Category B1			

(Source: http://environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/building-construction_may-10.pdf)

Category 'B1'- Require EIA report

Category 'B2'- Does not require EIA

All B2 category projects does not require complete EIA to be made, these projects are appraised on the basis of Form-I, Form-IA and conceptual plan and detailed annexure including plans. All B category projects have to go through scoping stage for further process.

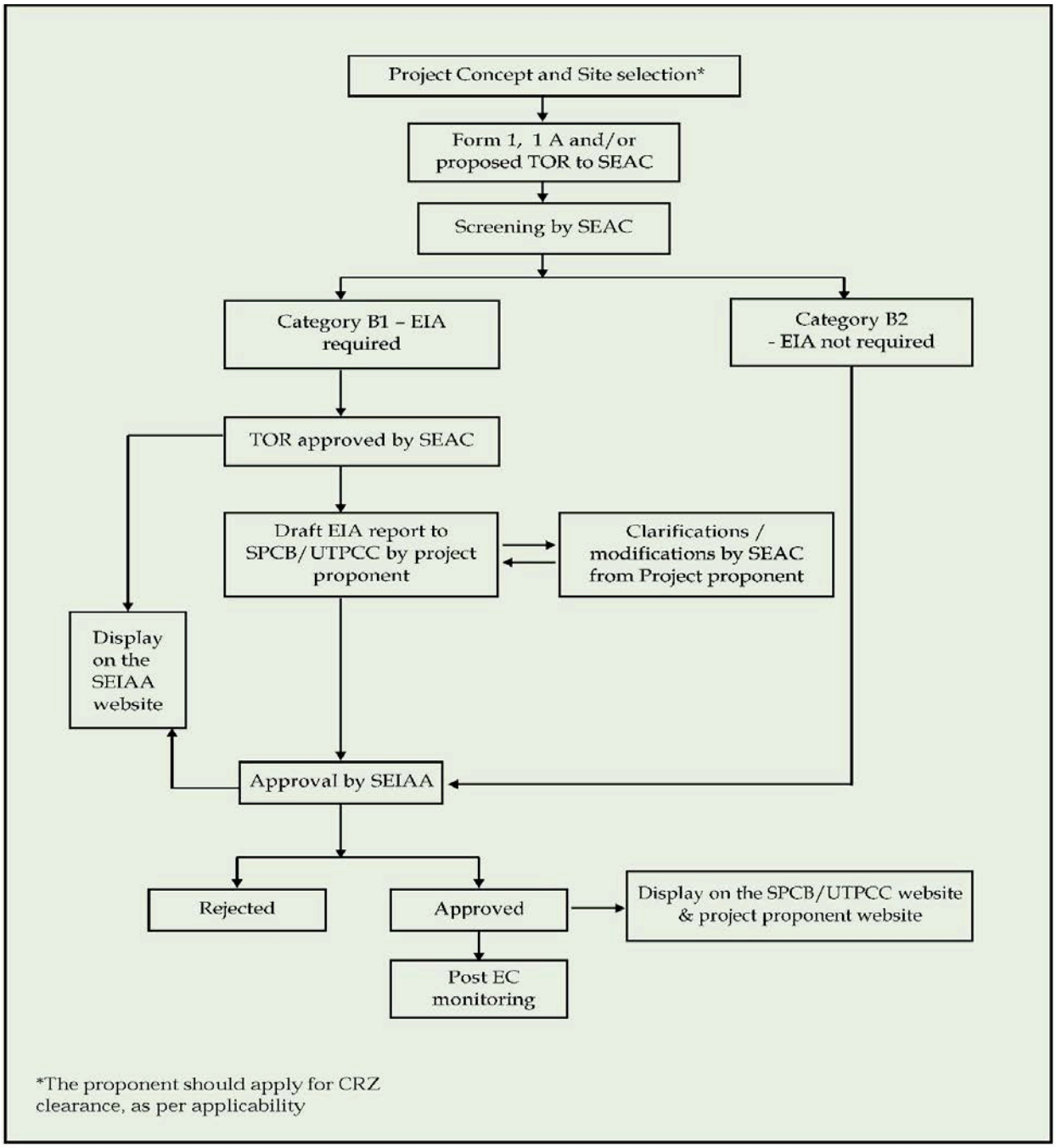


Figure 2.1: Flow diagram of EIA clearance process for construction projects

(Source:http://environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/building-construction_may-10.pdf)

2.1.1 Specific condition for which project will be considered in "A" category:-

Any project or activity specified in Category 'B' will be treated as Category A, if located in whole or in part within 10 km from the boundary of:

(i) Protected Areas notified under the Wild Life (Protection) Act, 1972,

(ii) Critically Polluted areas as notified by the Central Pollution Control Board from time to time,

(iii) Notified Eco-sensitive areas

(iv) Interstate boundaries and international boundaries.

- Projects which are located within 10 Km of the National Parks, Biosphere Reserves, Sanctuaries then project proponent shall submit conservation plan for the same duly authenticated by Chief Wildlife warden showing these features at the stage of clearance (EC).
- Authorized signatory on the behalf of project proponent shall attend the EAC meeting; subsequent clarification required from time to time shall be made. The authorized signatory should also submit a document to claim of being authorized signatory for specified project.

For simplification of construction projects, application and appraisal procedures have been simplified, so that development of this sector is not retarded. **These projects (Item 8) have been exempted also from the public hearing.**

2.2 BRIEF DESCRIPTION OF EIA REPORT:-

This section covers with necessary details and plans required for preparing an EIA report.

Initially, Form-I, Form-IA and Conceptual plan need to be submitted with all the necessary Annexure. In report details of project proposed, its location and pro & Cons to the country need to be specified. Latitude & longitude, site surrounding (nearest amenities), Khasra nos, Client name & address, Consultant name & address has to be provided.

Information regarding any Litigation pending against the project, details of any national environment laws applicable for the project needs to be furnished.

In case of expansion/modernization of the project, the six monthly compliance report's status for activity already proposed is compulsory before applying for its existing phase.

2.2.1 Essential Details Required With Application:

Location and its description (Maps showing location, project boundary)

2.2.2 Toposheets to be provided with TOR application:

- A map of 2 km study area from the boundary of the project site, depict major topographical features such as land use, rivers, wildlife sanctuaries, national parks, national and state highways, industries if any in the area are to be mentioned.
- A map of 10 Km study area (aerial distance) from the project site boundary highlighting environmental sensitive places, river/drain , national or state highway if any and these details are to clearly mentioned in Form-I also.

2.2.3 Remote Sensing Satellite Imagery

- Land use map depicting what is land use pattern of the study area in form of forest, water bodies, agricultural/ cultivated land, settlements, fallow land and other features.

2.2.4 Contour Map

- Contour map should be provided of project site with contour levels in MSL value (Mean sea level).
- Metrological climate of the study area, Windrose diagram, alternative source of energy used are to be studied.
- Details of land acquisition, landscape, drainage, connectivity, to project site and present status of such activities are to be mentioned.
- Detail of DG Sets requirement, power requirement, water requirement and solid waste generated is to be mentioned clearly.

- Traffic circulation plan and parking details should be given. Proper traffic study is to be conducted to identify incremental traffic road on nearby state and national highways.

2.2.5 Site Selection

- Proposed project site should be as per Master plan for that city otherwise no objection for change in land use certificate must be obtained from concerned authority. Basic facilities should be available for labors i.e. sanitation, drinking water and other.

2.2.6 Details from Architect scope

- Approved site layout plan, traffic circulation plan, section and elevation plan, external service plan, structure stability certificate will be compulsory at the appraisal of project before SEAC/EAC.

2.2.7 Noc's and permissions

- Water assurance for construction and operation phase from concerned authority is mandatory.
- Power assurance, treated water assurance and disposal of treated water to sewerage assurance is also required
- Forest NOC, aravali and NOC from Airport Authority of India (AAI) in case of height of building is above than 50 m shall be obtained.

2.3 ENVIRONMENTAL MONITORING PLAN:-

This includes proper details that what parameters are to be monitored and their frequency, location of monitoring and detailed budget for EMP should be given. Monitoring of parameters should be as per CPCB norms and effective analysis of data should be stated. The environmental monitoring include

- Air pollution
- Noise level monitoring
- Water Quality monitoring and Ground water level monitoring
- Maintenance of rainwater harvesting pits and other water conservation methods.

2.4 ENVIRONMENTAL MANAGEMENT PLAN:-

The Environmental Management Plan (EMP) is the most important of all proposed mitigating and monitoring actions, which assign a duty after getting clearance. The EMP basically means to plan the activities in such a way that mitigation measures should be followed and time to time monitoring should be done once project is in operation phase.Environmental Management Plan (EMP) also includes environmental monitoring plan and training plan for implementation of environmental management plan.

- The environmental management should be given both for construction and operation phase.
- The plans to be given for energy conservation, wastewater handling and the solid waste management plan are to be detailed out.
- Landscaping should be planned in a way to reduce noise and to minimize dust. Fast growing trees should be proposed at the site.
- Sewage treatment plant and organic waste convertor has to be designed at project site to treat the wastewater from the building and biodegradable waste generated in operation phase.

2.5 POST ENVIRONMENTAL CLEARANCE MONITORING:

After getting of clearance either by MoEF/SEIAA, the project proponent shall advertise in the newspapers indicating that the project has been granted environmental clearance and the details will be displayed on MoEF website also. The Project proponent shall submit half-yearly compliance reports in respect of the environmental clearance terms and should submit on 1st June and 1st December of each calendar.

2.6 VALIDITY OF ENVIRONMENTAL CLEARANCE:

The environmental clearance is valid for a period of five years. This validity can be extended further up to five years but proper report (updated Form 1, and Supplementary Form 1A) should be prepared and submitted to concerned authority. Application for extension should be filed within the validity period of EC. (Building & Construction manual, 2006)

2.7 AMENDEMENTS IN NOTIFICATION FOR CONSTRUCTION SECTOR:-

2.7.1 Subject- Consideration of proposal of Construction Sector (Date-05/02/2008)

Before this amendment, it was noticed that there was delay in submitting necessary building plan (site layout, external services layout) by project proponent now submission of plans are made mandatory before getting clearance and EC will be granted once all the plans and documents are completed.

2.7.2 Subject-Stipulation of condition to improve the condition of Construction Labors at Site (Date-22/09/2008)

Is has been notified, while granting environmental clearance to any projects under the EIA notification, 2006, the following conditions shall be implemented.

"Provisions for the housing of Construction labor deployed at the site shall be made within the site and all necessary infrastructure and facilities such as mobile toilets, fuel for cooking, safe drinking Water, medical facilities, crèche etc. The housing may be temporary structures i.e. to be removed after the completion of the project"

2.7.3 Subject- Instruction for the project proponent (Date-04/08/2009)

In the past, quality of EIA reports was not up to the mark and submission of documents was delayed and there was no participation from the proponent in the EAC meeting. After observing all these issues MoEFCC has set certain guideline for the project proponent seeking environment clearance for their project which is as follows:

- Name of consultant, accreditation number and their address should be mentioned which they hire for preparing EIA report at the time of environment clearance or submission of application for grant of ToR whether from SEIAA or EAC.
- Project proponent along with authorized signatory and consultant should present their case before the committee; consultant alone will not be allowed to present their case before the respective authority.

2.7.4 Subject -Activities which can be undertaken without prior EC (Date-19/08/2010)

Instances have come to the notice of the Ministry where the project proponents have already undertaken construction activities relating to the project at site without obtaining the prior EC as it is mandated. It is to reiterate that the notification, 2006 mandates prior EC to be obtained in respect to all the activities listed in the procedure. No activity can be undertaken at site without obtaining prior EC except fencing of the proposed project site and construction of temporary sheds for the guards. It may be noted that any contravention of the provisions of EIA notification amounts to violation of the Environmental (Protection) Act, 1986 and would attract penal action.

2.7.5 Subject-General condition for the project (Dated-25/06/2018)

As per this notification any project or activity specified in category "B" will be appraised as category "A" if any protected area under Wildlife Act1972, critically polluted area, inter-state boundary comes under 5 Km from the project boundary.

2.7.6 Subject- Provides Six-Months Window to Get Environmental Clearance to Deal with Cases of Violation (Date-14/03/2017)

MoEFCC has received many proposal seeking clearance which have already started construction activities before getting prior EC or have extended their project & increased the production capacity without informing the Ministry, which comes under violation category as per EIA notification 2006. After this notification Ministry provided a window for 6 months where proponent can apply the projects which comes under violation category from March 2017 to September 2017

All the cases of violation, irrespective of category, will be appraised as category "A" projects by respective sector Expert Appraisal Committee (EAC) at Central level. So, violation cases can only be appraised at the level of Ministry.

2.7.7 NGT order- for stay of appraisal of violation cases at EAC(Dated-08/12/17)

As per order by National Green Tribunal (NGT) of India, violation cases as per EIA notification, 2006 applied for clearance after notification dated 14/03/2017 shall be appraise at state level

instead of appraised by ministry (Moef&CC). Till any judgment made any Honorable NGT, no case shall be appraised by EAC.

2.7.8 Subject- Violation cases shall be appraised at state level (Date-08/03/2018)

Before this notification , all violation cases was to appraised as category "A" projects by EAC but after NGT order , now all violation cases will be appraised at state level i.e. by SEIAA and SEAC. The proposal received up to 13th September, 2017 on the portal of ministry, shall be considered by the EAC but cases yet not considered by EAC shall be transfer online to the SEAC/SEIAA in respective state.

- All the projects of category "B" pertaining to different sectors, once considered by EAC and accorded ToR to the project shall be appraised further for grant of EC by the respective SEIAA/SEAC only.

2.7.9 Subject- Requirement of license for appraisal of construction projects, Haryana Government (Dated-17/04/2018)

As grant of license by the Town and country planning department (DTCP) takes a lot of time and the proponents are requesting to appraise their project without license or by submitting receiving of application given to DTCP. In that case it has been decided that:

- The project proponent can submit credible document showing land acquisition or land ownership. Proponent can give letter of intent (LOI) instead of original license
- It is clarified that after grant of license/ approved layout plan/approved Zoning plan, if there are further change in green belt plan, RWH plan, traffic circulation plan then proponent have to seek revised environmental clearance.

2.7.10 Subject-Corporate Environmental Responsibility (CER) (Dated-1st May, 2018)

The concept of CSR is provided by Companies Act, 2013 and 2014, but there was no common principles followed for formulation of CER. Now, the fund allocation for the activity shall be common for different projects irrespective of EAC or SEAC. Maximum percentage of total cost is described for projects. Categories are defined on cost of the project and whether project is Greenfield project or Brownfield project.

2.7.11 Subject-Increase in threshold value for EC (Dated-13/03/2018)

Central government is streamlining the permission for building and construction sector to achieve housing for all by 2022 especially for weaker section. In regards to this it is proposed to increase threshold value to 50,000 Sq.mt which is presently 20,000 Sq.mt.

2.8 IMPACTS OF CONSTRUCTION ACTIVITY ON ENVIRONMENT:

As against the global average of 5.5%, Indian construction industry is growing at a pace of 9.2 %. The EIA analysis all aspect of impacts of any activity on environment which includes ecological, communal, social, educational and aesthetic conditions and it also considered stress of any activity on natural resource.

As per study by Sengupta & Dutta (2014), construction of any building or road network affects the surrounding crucially in two ways- one is by extensive use of resources (whether natural or manmade) and by generative too much of waste and contaminates.

Spence & Mulligan (1995) concluded that globally, we have reached to a critical stage of degradation of resources particularly in erosion of soil, loss of biodiversity, threats to species, loss of forest, reducing world capacity of food as population is increasing due to change in land use which results in urbanization and industrialization. He also concluded aggregating of pollution concentration in environment and threat of climate change globally with increasing global warming. Whereas Sengupta & Dutta (2014) concluded that with industrialization and urbanization growth, there is increase in solid and liquid wastes. Construction activities further add-on to the ever increasing solid wastes.

The construction industry is responsible for 50 % of raw material consumption and is directly or indirectly reason for the Greenhouse gases emission. 50 % of global resources (water, energy, land, material) are consumed by this industry. At least 3 billion tons of material (40 % of total global material flow) is utilized in construction activities each year and it produces about 2 million tons of construction & demolition waste every year as documented by Sev (2009) and where as a study conducted by Sengupta & Dutta (2014), construction industry accounts for 60 % usage of unprocessed raw material, approximately 45-50 % of power consumption during construction and operation phase and more than 50 % of water usage. Also, the construction

activities result in 23 % of atmospheric contamination in form air pollution, 40 % of water contamination, 50 % of climate change gases, in addition to this 50 % of landfill wastes.

An efficient infrastructure of the country is very crucial for its development due to this construction industry is vast in developing countries in comparison to developed countries. This is important for acceleration of development especially in poor countries and for human development for rising their living conditions and standards. The construction of buildings has made cities dense and their growth vertical. Through site supervision can lessen down environmental impacts both on and off site.

As concluded by Sev (2009), main impacts of construction industry on economic, environmental, social are given below:

Impacts of construction industry	Environmental	Social	Economic
Raw material extraction and consumption , related resource depletion	Yes	No	Yes
Land use change, including clearing of flora	Yes	Yes	Yes
Energy use and associated emissions of greenhouse gases	Yes	No	Yes
Other indoor and outdoor emission	Yes	No	Yes
Aesthetic degradation	No	Yes	No
Water use and waste water generation	Yes	No	Yes
Increase transport needs, depending on site	Yes	Yes	Yes
Waste generation	Yes	No	Yes
Opportunities for corruption	No	Yes	Yes
Disruption of communities , including through inappropriate design and materials	No	Yes	Yes
Health risks on worksites and for building occupants	No	Yes	Yes

As per latest study conducted by Rathi (2017), “effects” are defines as the changes caused by anthropogenic activities by human and its result or consequences of these changes on environment or human and its well being are termed as “impacts”.

On a concluding note, major impacts from construction activities area- Change in land use pattern, multi storey building instead of single storey, clearing of surface vegetation, removal of top soil due to excavation, change in topography, change in drainage pattern, increase in air pollution noise pollution owing to heavy machineries and discarded waste.

According to the jayanthi Naranjan (2006) survey conducted on Capital of India Delhi, Highlights the condition of Delhi pollution which is extremely high if compared to our own and international ambient standards. Although there was success in CNG conversion programme in Early 2000s but the condition is getting deteriorated day by day. This proves that transport is only one fifth reason of causing pollution in Delhi. Other reasons that are responsible for the pollution in city are emissions from industries, power plants, waste burning and construction activities etc.

Below figure shows the areas which are majorly responsible for the pollution in Delhi. The black dots over the map shows the brick kiln industries which is approximately 60%. These kilns are actually not energy efficient and causing pollution. Although relocation of industries has proved beneficial but more promising approach will be changing the technology which is energy efficient.

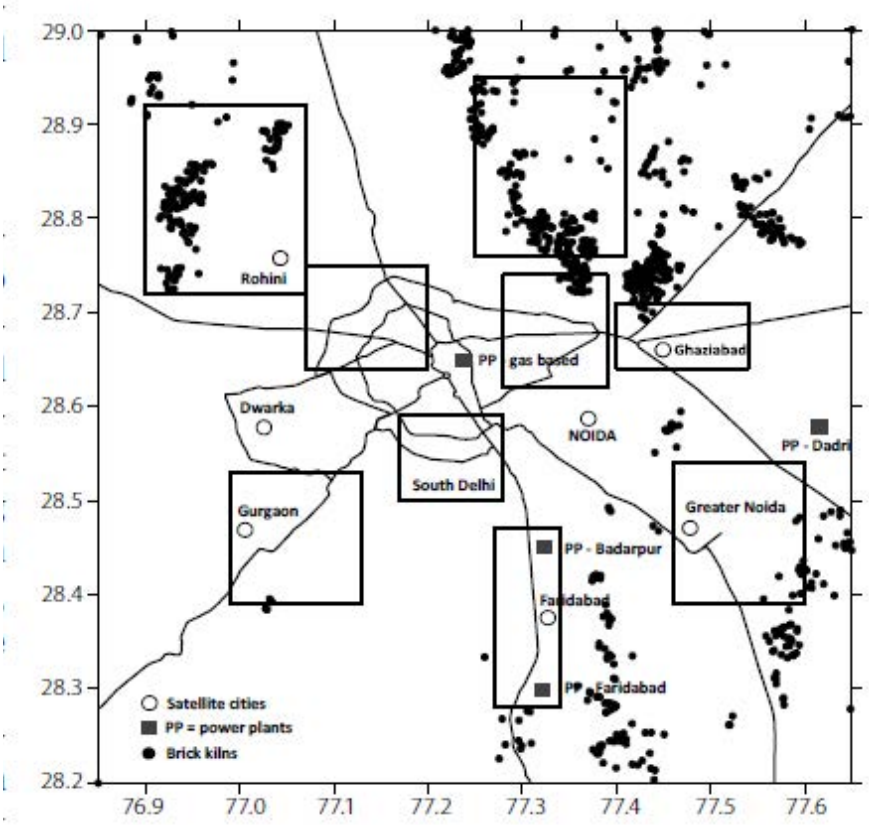


Figure 2.2: Study Domain over the National Capital Region of Delhi

Construction activitie has major impact on enviroment and air quality degradation. Taking into consideration air quality of NCR is of major concern. The increasing pollution levels have induced more health risks as justified by an increase in respiratory and cardiovascular ailments. As India'scapital,Delhi has grown across all sectors—industry, transport,andhousing,allof which have contributed to an increase in city air pollution (Narain andBell,2006;Goswami and Baruah, 2008; Firdaus andAhmad,2011; Guttikunda andGurjar,2012; Sahu etal.,2011; Guttikunda, 2012). As per Sarath K. Guttikuda and Rahul Goel (2013), Transport exhaust contribute 17 % and 13% in concetration of PM_{10} and $PM_{2.5}$ respectively and Diesel gen sets contribute 6% and 4% in concetration of PM_{10} and $PM_{2.5}$ respectively and construction activities constribute 5% and 9% concetration of PM_{10} and $PM_{2.5}$ respectively. Where as construction activity only contribute 1 % each in SO_2, NO_2 and CO concentration.

The changes in thermal behavior of the regional and constantly change in climate is due to urbanization and industrialization are well studied and documented. It is now understood that,

the urbanization results in changes in atmospheric radiative balance due to an increase in the pollutants in atmosphere, aerosols and particulate matter; changes in the circulation pattern due to variation in heating process and sensible heat exchange; and changes in surface energy balance due to alteration in solar albedo and thermal capacity of soil.

In today world, there is growing awareness for air quality which led to use of air pollution constrol strategies. For this strategies to be made and provide maximum benefit it require detailed information for Baseline scenario of air and also the future prediction of air quality for any proposed project. Air dispersion modeling is the method to predict cumulative ground level concentration of any project and provide the information in simple manner. In India, mainly used software is Industrial Source Complex (ISC) due to its simplicity. AERMOD is the improved version of ISC tool. It takes into account many parameters and conditions which was neglected by earlier software.

The dispersion of pollutants depends completely on local meteorological parameters (wind speed, wind direction, relative humidity, mixing height) and therefore this information is a crucial input for any dispersion modeling. Air quality models also may other factor which also incorporates parameterization for Planetary Boundary Layer (PBL), plume rise, turbulence due to building, downwash effect, terrain nature (flat or elevated). AERMOD is a Gaussian plume model, which is more efficient and accurate in comparison of other models. For this model certain meteorologically inputs are necessary which provide the information about the climatic condition of study area.

For ambient Impact assessment study, Aermod is used without considering its limitations. After so many limitations Aermod dispersion model is still more efficient in comparison to other models. It takes into consideration flat or complex terrain, surface or elevated release, rural or urban area, land use pattern of study area. It also assumes certain parameters i.e. homogenous dispersion in horizontal and vertical direction. Emission sources can be provided individually by clicking on the source point or by specifying GPS co-ordinates. Emission source can be point, area or line source. For Aermod processing emission rates and average computing time should be provided. This model aims at short-range (up to 50 Km) dispersion.

2.9 Mitigation measures of impacts from construction activity:

For this new millennium, sustainability can be the only solution for the increasing environmental issues. As well mitigation measures suggested by Sev (2009), proper resource management and precise pre and post building design should be there. There should be efficient use of energy by implementing alternative source of energy (solar, wind geothermal energy) rather than using fossil fuel. There should be use of "passive solar design" to eliminate the need for mechanical ventilation, so that heating loads can be minimized and as a result water consumption will be reduced to great extent as documented by Spence & Mulligan (1995). In order to reduce ecological impacts and to screen out fugitive dust, green belt shall be proposed which also increases its aesthetic value as suggested by Rathi (2017).

Water is a scarce resource, so its usage shall be minimized in every aspect this shall also reduce waste water generated. Water usage can be reduced in following ways as studied by Sev (2009):

- By utilizing efficient plumbing fixtures, bio-compositing toilets, low flow showers, re-circulating water for commercial usage
- Low demand landscaping should be designed at the project site.
- Proposing RWH pits for irrigation purpose
- More use of treated water

2.10 Drawback of EIA:

EIA can be considered as the tool for assessment of the possible impact that a proposed project can have on natural Environment whether positive or negative as well documented by Sengupta & Dutta (2014).

The origin and development of EIA and issues in EIA-theory, practice and effectiveness are reviewed by Morgan et.al (2012), taking a detail perspective of EIA, effective evaluation of EIA reports and methods was carried out by Christopher wood et.al (1999). EIA is carried out to make decision for proposed project whether it should get clearance or not from environment point of view. But there are many bottle-necks and limitations in EIA process, which makes it less effective and worthless.

Major drawback of EIA in India is terms of its effectiveness are reviewed by Rathi (2017) after evaluation of more than 90 EIA reports over a period of 8 years which include reports from construction sector, highways, thermal power plant and metallurgical industry.

Today, in India EIA reports are not up to the mark and not appropriate as standard template is used irrespective of project nature. Weakness in the system is its weak administrative set up, inadequate screening and scoping, poor quality of EIA reports, limited review, inadequate public participation and inadequate implementation of mitigation measures and monitoring. EIA process just becomes formality for regulations of paper work rather than good and genuine practice.

Further due to large number of projects seeking environmental clearance, its mechanism is under severe pressure of time. The project proponents put pressure on their representatives for getting clearance without any delays, thus the committee have limited time for reviewing the EIA reports and may be committee just get 15-20 min for listening to the presentation of the project by proponent which is not enough for decision making.

Monitoring of biophysical and socio environments during report preparation is rarely done only physical environment is considered. As such monitoring results of air and water are altered. This is the major weak link in the EIA process. . The prescribed structure of EIA report (MoEF, 2006) is not strictly followed, and the ToR points are not strictly complied with. Standard templates are generally used for all he EIA report; irrespective of complexities of the project and environment sensitivity of the study area.

Although EIA framework and regulation has immensely changed from 1994, in terms of delegation of powers to state level and well defined process incorporating international conventions but still there are many loopholes which needs to be filled.

EIA consultants should educate project proponents the importance of EIA, who only considered this as a speed breaker in their plans. Economic development and environmental management of the country should go hand in hand.

CHAPTER-3

MATERIALS AND METHODS

M/s Baakir Real Estates Pvt. Ltd. proposes to develop an "Expansion of IT park" located in Gurgaon for which Environmental Clearance has already granted from SEIAA, Haryana vide letter no. The company has already acquired the land measuring 8.356 acres at Sector-62, Village- Medawas, District- Gurgaon, Haryana to develop an IT Park at the proposed site. The License has already been taken from Directorate of Town & Country Planning, Haryana vide Memo No. LC- 1629-PA (SN)-2015/20754 dated 21/10/2015. The complex would include IT offices and Commercial Area. The total plot area is 33815.48 m^2 (8.356 Acres). As per EIA Notification this project falls in schedule 8 'b' of category 'B' as the total built-up area is 1,80521.759 m^2. Thus, EIA study has been done for this project to get Environmental Clearance from SEIAA, Haryana. The project site has been earmarked for the commercial land use according to Gurgaon-Manesar Master Plan 2031.

3.1 STUDY AREA:

The proposed project site is located at Sector-62, Village- Medawas, District- Gurgaon, Haryana.

The Co-ordinate of the project site is
28°24'06.07"N
77°05'07.24"E

Baseline study for 3 months was conducted at project site and in 10 Km radius from boundary of project site. Study was conducted in the month of October, November and December (post monsoon) as per CPCB norms. Baseline study for air, noise, soil, water, socio-economic conditions and its ecological biodiversity is conducted.

3.2 Connectivity:

The site is easily approachable through NH-8 at a distance of approximately 8.55 km in NWW direction from project site. The nearest railway station is Basai Dhankot Railway Station at a distance of approximately 12km. towards NW of the proposed project site. The nearest airport is Indira Gandhi International Airport at a distance of approximately 17.24 km towards NNE of the project site.

Figure-3.1: Google image showing the project site

3.3 Project Layout:

Any project of construction activity is based mainly on its area statement on basis of which categories are defined. Area statement includes permissible and proposed ground coverage and Floor area ration (F.A.R), non FAR area which includes basement, mumty area and service area in the building.

Total population, water required solid waste generated is calculated as per norms defined by Moef& CC. Summarized details of the project in respective of operation phase for Expansion phase and Existing phase (as per previous EC) are given below:

Table3.1: Area statement of proposed project

S. No.	Particulars	As per previous EC (m^2)	Expansion	Total Area (m^2)
1	**Project Name:** IT Park M/s Baakir Real Estates Pvt. Ltd.			
2	**Activity in the complex:** IT offices and Commercial Area			

3	Total plot Area	33815.48		33815.48
3(a)	Net Plot area			30152.619
4	Permissible ground Coverage @ 40%	13526.192		13526.192
5	Proposed Ground Coverage@ 31.72%			10771.07
	AREA UNDER IT UNIT			
6	Area under IT unit @96% of total plot area			32462.86
7	Permissible FAR under IT @250%	81157..152		81157.152
	AREA UNDER COMMERCIAL			
8	Area under commercial @4% of total plot area			1352.6192
9	Permissible FAR under Commercial @150%	2028.93		2028.93
10	FAR under GRIHA			2798.17
11	Total permissible FAR (IT + Commercial+ GRIHA)			85984.25
12	**Proposed FAR (IT+ Commercial +GRIHA)**			**85864.553**
a	Proposed FAR for IT units			83842.918
b	Proposed FAR for Commercial			2021.635

13	Non-FAR (Basement Area+ MLCP)	76509	18148.206	94657.206
14	**Built-up area(FAR+ NON-FAR)**	**144584**	**35937.759**	**180521.759**
15	Proposed Green Area	8453.87 m^2 @25% of Total plot area		7538.15 m^2 @25% of Net Plot area
16	Road & Paved area			11843.299
17	Power Requirement & Sources	11210.63 KW		8257.73 KW (10321.25 KVA) Source: Dakshin Haryana Bizli Vitran Nigam
18	Water requirement & Sources	Total Water Requirement: 565 KLD Fresh Water Requirement: 219 KLD Total Waste Water Generation: 296 KLD Source: HUDA		Total Water Requirement: 362 KLD Fresh Water Requirement: 147 KLD Recycled Water Requirement: 215 KLD Total Waste Water Generation: 268 KLD Source: HUDA
19	Estimated Population			9681 persons
20	Rain Water Harvesting Pits	07	01	08
21	Cost of the project			304 Crores

3.4 AIR ENVIRONMENT:

This section documents the baseline scenario of the air environment for the study area and discusses both air resources and quality. The air quality at site and other locations within a radius of 10 km was monitored at 8 locations over a period of post-monsoon season i.e. 1st October 2017 to 31st December 2017. Major air pollutants i.e. Particulate Matter (PM_{10}), $PM_{2.5}$, Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO) represents the basic air pollutants in the region for Ambient Air Quality Monitoring (AAQM).

3.4.1 Onsite climatic conditions:

Gurgaon has a dry, semi-arid climate. The average minimum and maximum temperature vary from 2 °C to 46 °C during January (winter) and October–June (summer) respectively. The maximum temperature in summer can go up to 46 °C from March to August. Minimum temperature can fall up to 2 °C in December and January.

Table 3.2: Onsite Meteorological Data

(1st Oct, 2017 – 31th Dec, 2017)

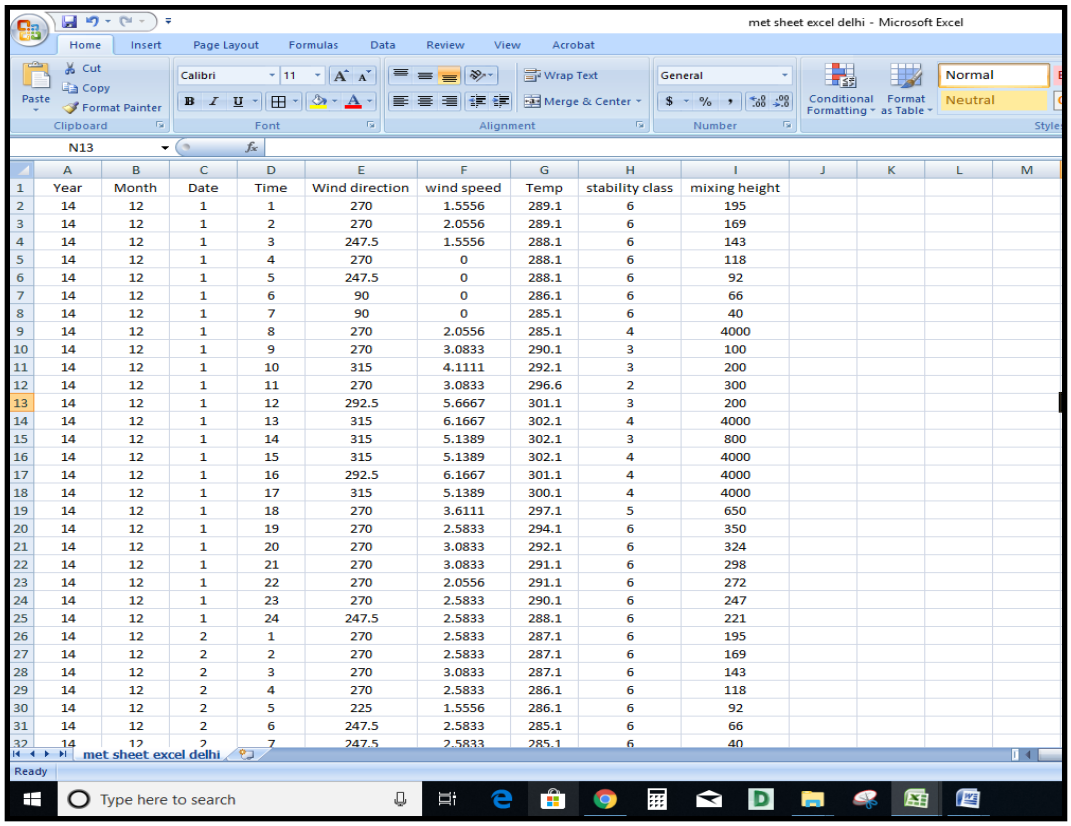
Month	Temperature		Relative Humidity		Wind Speed (Km/hr)	
	Max ^{0}C	Min ^{0}C	Max. %	Min. %	Max.	Min.
October, 2017	37	17	94	11	100	2
November, 2017	33	9	100	13	167	2
December, 2017	29	7	100	17	126	0

3.5 Ambient air Monitoring:

3.5.1 Selection of Sampling Locations:

For selecting the sampling location, wind rose diagram is prepared for the project site. Wind rose diagram was prepared to study the wind pattern to the location. With the help of this, dominating wind direction and speed is identified. For preparing Windrose diagram, the metrological data of

IMD station Delhi (IGI airport which is approx. 17 Km away from project site) was taken. The metrological parameters such as temp, rainfall, humidity, wind direction, wind speed etc. control the dispersion and transport of air pollutants during different seasons. The screenshot of excel sheet for metrological data is given below.



met sheet excel delhi - Microsoft Excel

	A	B	C	D	E	F	G	H	I
1	Year	Month	Date	Time	Wind direction	wind speed	Temp	stability class	mixing height
2	14	12	1	1	270	1.5556	289.1	6	195
3	14	12	1	2	270	2.0556	289.1	6	169
4	14	12	1	3	247.5	1.5556	288.1	6	143
5	14	12	1	4	270	0	288.1	6	118
6	14	12	1	5	247.5	0	288.1	6	92
7	14	12	1	6	90	0	286.1	6	66
8	14	12	1	7	90	0	285.1	6	40
9	14	12	1	8	270	2.0556	285.1	4	4000
10	14	12	1	9	270	3.0833	290.1	3	100
11	14	12	1	10	315	4.1111	292.1	3	200
12	14	12	1	11	270	3.0833	296.6	2	300
13	14	12	1	12	292.5	5.6667	301.1	3	200
14	14	12	1	13	315	6.1667	302.1	4	4000
15	14	12	1	14	315	5.1389	302.1	3	800
16	14	12	1	15	315	5.1389	302.1	4	4000
17	14	12	1	16	292.5	6.1667	301.1	4	4000
18	14	12	1	17	315	5.1389	300.1	4	4000
19	14	12	1	18	270	3.6111	297.1	5	650
20	14	12	1	19	270	2.5833	294.1	6	350
21	14	12	1	20	270	3.0833	292.1	6	324
22	14	12	1	21	270	3.0833	291.1	6	298
23	14	12	1	22	270	2.0556	291.1	6	272
24	14	12	1	23	270	2.5833	290.1	6	247
25	14	12	1	24	247.5	2.5833	288.1	6	221
26	14	12	2	1	270	2.5833	287.1	6	195
27	14	12	2	2	270	2.5833	287.1	6	169
28	14	12	2	3	270	3.0833	287.1	6	143
29	14	12	2	4	270	2.5833	286.1	6	118
30	14	12	2	5	225	1.5556	286.1	6	92
31	14	12	2	6	247.5	2.5833	285.1	6	66
32	14	12	2	7	247.5	2.5833	285.1	6	40

Figure3.2: IMD metrological data of IGI Airport

Wind rose diagram is plotted to select the monitoring station for study area. The wind rose diagram for this period is shown in the Figure: 3.4. The overall average wind speed was 2.29 km/hr. The most predominant wind direction is West followed by SE as per Wind rose.

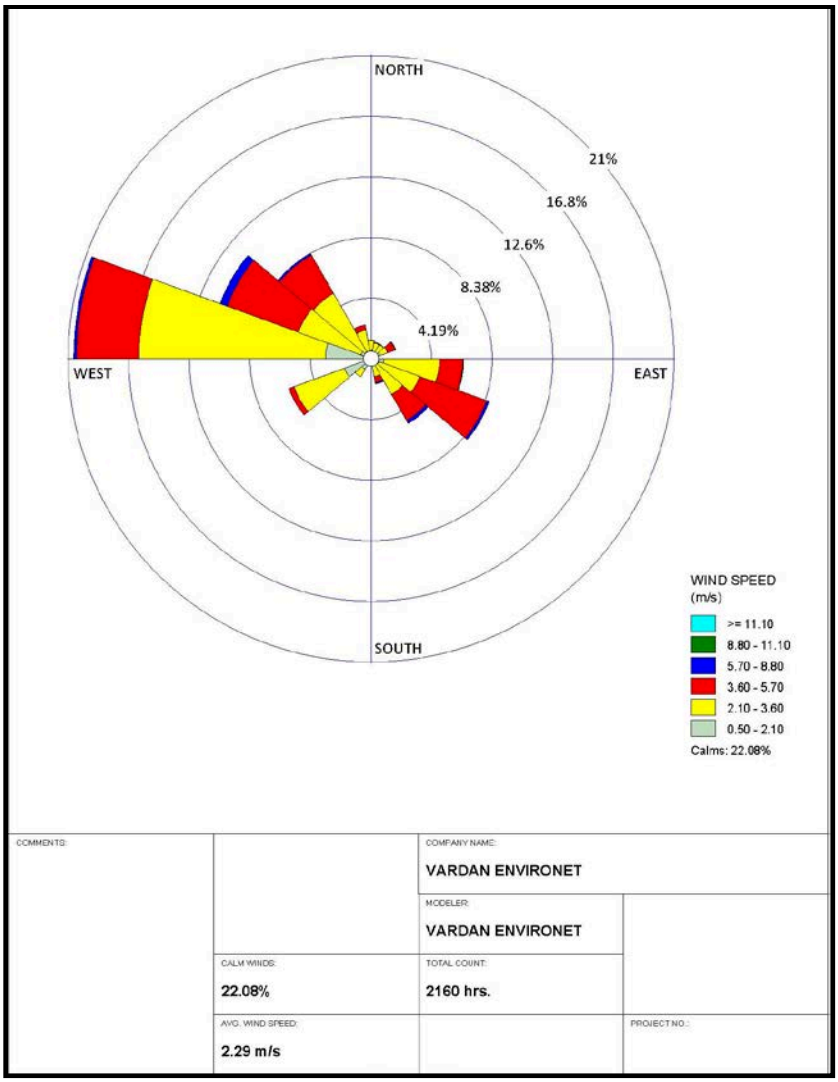


Figure3.3: Windrose diagram of project site

After plotting Wind rose diagram, eight sampling location are marked including project site for air quality monitoring. As per CPCB guidelines, two locations in crosswind direction, two in up wind and down wind direction respectively. As per guidelines site should be away from major pollution source, instrument should not be located in a confined place or corner, sampling intake should be 3 m above the street level and location of monitoring should be vandal proof and should be protected from extreme weather conditions.

Ambient air monitoring was carried out on monthly basis in the surrounding areas of the project site to assess the ambient air quality. To know the ambient air quality of the study area, air quality survey has been conducted at 8 locations including project site over a period of post-

monsoon season i.e. October 2017 to December 2017. The ambient air quality monitoring stations is given in **Table- 3.3** and depicted as **Figure- 3.4**.

Table- 3.3: Ambient Air Quality Monitoring Locations

Stations	Name	Latitude	Longitude	Distance (km)	Direction
A1	Project Site	28°24'10.1"N	77°05'06.0"E	--	--
A2	Alahawas	28°24'25.4"N	77°05'37.4"E	0.8	NE
A3	Tigra	28°25'01.6"N	77°04'23.0"E	2.0	NW
A4	Nurpur Jhadsa	28°23'01.2"N	77°02'18.3"E	5.0	WSW
A5	Khera	28°22'59.9"N	77°05'31.1"E	2.0	SSE
A6	Bherampur	28°25'00.3"N	77°01'18.4"E	6.4	WNW
A7	Rithanj	28°20'37.0"N	77°06'04.2"E	6.5	SSE
A8	Madi	28°26'21.2"N	77°08'37.4"E	6.9	NE

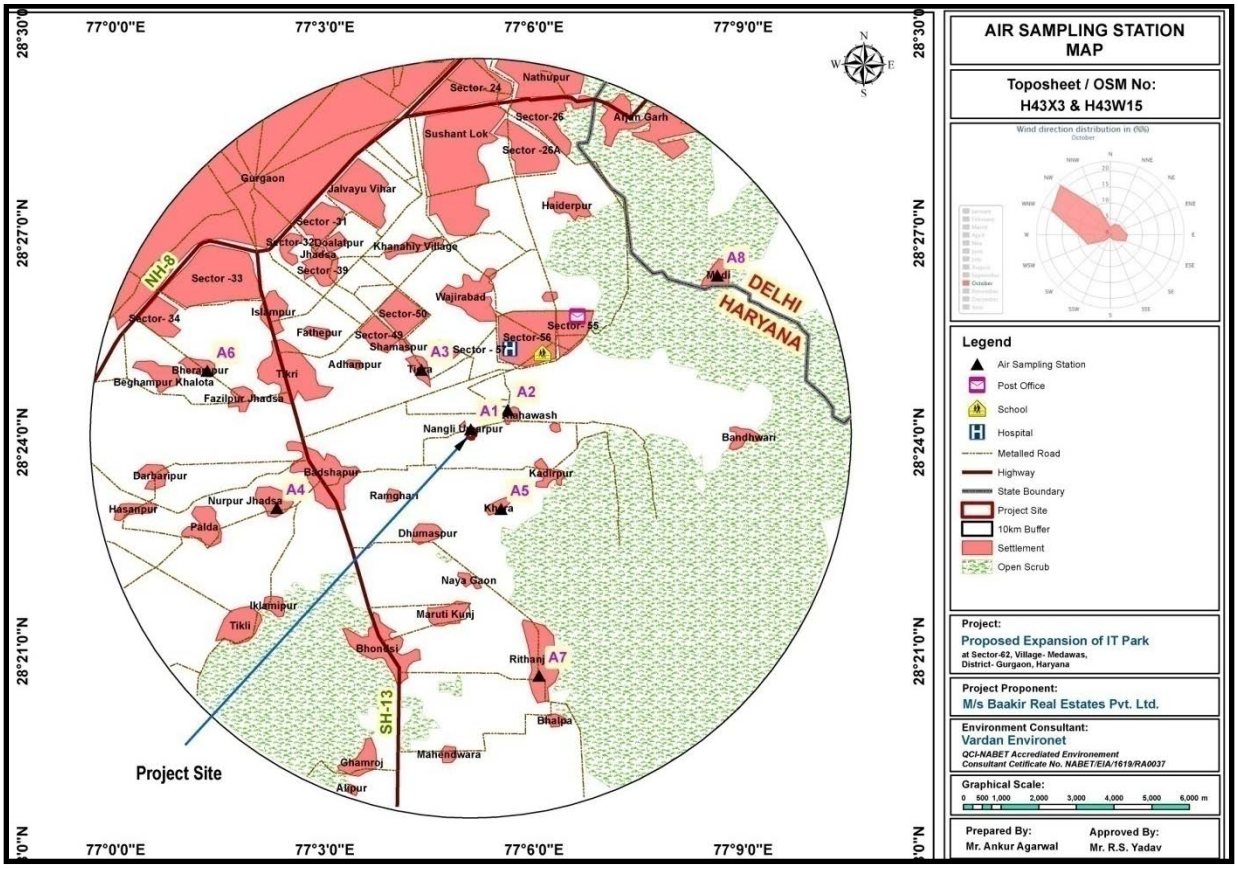


Figure3.4: Map showing Air sampling locations

3.5.2 Parameters, Frequency and Monitoring Methodology:

Ambient Air quality monitoring was conducted in respect of the following parameters:

- Particulate Matter (PM_{10})
- Particulate Matter ($PM_{2.5}$)
- Sulphur Diohxide (SO_2)
- Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)

Monitoring was carried twice a week for three months at each marked station for 24 hours except for CO, for which monitoring was done for 1 hour. Sampling was done in keeping mind the guideline mentioned by CPCB. Sampling equipment was placed in such a way that external affects can be minimized and real time results could be achieved. Equipment was placed at a height of minimum 3 to 3.5 meter above the ground to avoid the dust turbulence. Neither equipment was placed in corners or confined places and nor in space covered with trees which can act as sink for pollutants. It was also place minimum 10 meter away from major roads.

Table 3.4: Methodology for Ambient Air Quality Monitoring

Parameter	Measurement Methods
PM_{10}	Gravimetric
$PM_{2.5}$	Gravimetric
SO_2	Colorimetric (EPA modified West and Gaeke Method)
NO_2	Colorimetric (Arsenite modified Jacobs and Hochheiser Method)
CO	Gas Chromatography

3.5.3 Monitoring Results

Monitoring station-wise minimum and analysis (minimum, maximum, 98% tile & Average) for measured levels of PM_{10}, $PM_{2.5}$, SO_2, NO_2 and CO in study area for the monitoring period 1st Oct to 31st Dec, 2017 are shown parameter wise in Table-3.5.

Table 3.5: Results of Ambient Air Quality Analysis of Period (1st Oct – 31st Dec, 2017)

Locations	Parameters	PM_{10}	$PM_{2.5}$	NO_2	SO_2	CO
Project Site (A1)	Maximum	290.50	100.50	31.30	11.50	2.10
	Minimum	187.60	69.40	16.50	6.10	0.68
	Average	247.00	87.63	24.47	9.19	1.23
	98 % tile	289.50	100.45	30.90	11.45	2.06
Alahawas (A2)	Maximum	288.90	100.30	31.60	12.30	2.10
	Minimum	185.30	69.30	15.50	6.30	0.64
	Average	250.30	85.59	23.44	8.85	1.28
	98 % tile	288.55	99.05	31.50	12.25	2.06
Tigra (A3)	Maximum	290.60	100.70	28.10	12.10	2.12
	Minimum	180.30	72.50	16.30	6.50	0.75
	Average	255.41	87.78	22.86	9.07	1.33
	98 % tile	288.25	98.60	27.55	11.60	2.11
Nurpur Jhadsa (A4)	Maximum	290.50	100.10	30.10	13.90	2.37
	Minimum	175.30	68.10	15.20	7.80	0.64
	Average	252.21	87.02	23.97	9.91	1.48
	98 % tile	290.35	99.85	29.95	13.20	2.35
Khera (A5)	Maximum	292.50	100.70	33.30	11.40	2.33
	Minimum	175.10	76.10	15.30	6.70	0.75
	Average	255.01	87.93	23.55	8.96	1.51
	98 % tile	289.90	98.45	31.90	11.15	2.30
Bherampur (A6)	Maximum	290.70	98.40	28.60	11.20	2.41
	Minimum	179.20	74.40	16.20	5.30	0.66
	Average	257.58	87.34	22.79	8.84	1.37
	98 % tile	287.45	97.40	27.95	11.15	2.36
Rithanj (A7)	Maximum	291.50	99.80	32.30	10.60	2.61
	Minimum	176.20	75.80	16.10	6.80	0.68

	Average	259.33	88.82	23.91	8.60	1.42
	98 % tile	290.95	99.10	30.90	10.50	2.43
Madi (A8)	Maximum	290.50	100.70	28.80	11.30	2.53
	Minimum	183.40	69.70	15.40	6.30	0.68
	Average	261.43	88.07	23.74	9.15	1.44
	98 % tile	290.45	100.40	28.60	11.00	2.37

(i) Particulate Matter ($PM_{2.5}$)

The 24-hourly average $PM_{2.5}$ level varied station-wise between 68.10 $\mu g/m^3$ to 100.70 $\mu g/m^3$ for the monitoring period 1st Oct to 31st Dec, 2017

(ii) Particulate Matter (PM_{10})

The 24-hourly average PM_{10} level varied station-wise between 175.30 $\mu g/m^3$ to 292.50 $\mu g/m^3$ for the monitoring period 1st Oct to 31st Dec, 2017.

(iii) Sulphur Dioxide (SO_2)

The 24-hourly average SO_2 level varied station-wise between 5.3 $\mu g/m^3$ to 13.9 $\mu g/m^3$ for the monitoring period 1st Oct to 31st Dec, 2017.

(iii) Nitrogen Dioxide (NO_2)

The 24-hourly average NO_2 level varied station-wise between 15.20 $\mu g/m^3$ to 33.30 $\mu g/m^3$ for the monitoring period 1st Oct to 31st Dec, 2017.

(v) Carbon Monoxide (CO)

The average CO level varied station-wise between 0.64 mg/m^3 to 2.60 mg/m^3 for the monitoring period 1st Oct to 31st Dec, 2017.

3.6 AIR QUALITY INDEX (AQI) :

Monitoring at project site and 7 locations from 10 km study area was carried out using High volume sampler. The collected samples were analyzed by Vardan Lab team. Concentration of

pollutants was measured in microgram/ cubic meter. In the present study AQI is calculated using standards of CPCB. The major air pollutant which can result harmful for human health has been SPM, SO_2 , NO_2, CO and Ozone. All parameters are not required for AQI calculation, so we considered $PM_{2.5}$, PM_{10}, SO_2, and NO_2. The method involves sub-indices formation and aggregation of sub-indices for each pollutant considered.

3.6.1 How AQI is calculated?

The AQI is calculated to known the air quality in real-time and it considered pollutant which have short term impacts. Eight parameters (PM10, PM2.5, NO2, SO2, CO, O3, NH3, and Pb) out of which five are critical pollutants having short-term standards have been considered for near real-time dissemination of AQI. To calculate AQI minimum three pollutants are required. AQI is calculated for from ground level concentrations of pollutants, which is manually or automatically monitoring. AQI of individual pollutant is calculated of site specific location and maximum value of AQI calculated from individual pollutant is considered to be the overall AQI of that location.

Table3.6: Pollutants Considered for AQI and Air quality standards

Pollutant	**SO_2**	**NO_2**	**$PM_{2.5}$**	**PM_{10}**	**CO (mg/m^3)**	
Averaging time (hr)	24	24	24	24	1	8
Indian Standard ($\mu g/m^3$)	80	80	60	100	4	2

The AQI system is based on maximum operator of a function (i.e. selecting the maximum of sub indices of individual pollutants as an overall AQI). A scientific basis in terms of attainment of air quality standards and dose-response relationships of various pollutant parameters have been derived and used in arriving at breakpoint concentrations for each AQI category.

The sub-index (Ip) for a given pollutant concentration (Cp), as based on 'linear segmented principle' is calculated as:

$$\mathbf{Ip= [\{(I_{HI} - I_{LO})/ (B_{HI} -B_{LO})\} * (Cp-B_{LO})] + I_{LO}}$$

B_{HI}= Breakpoint concentration greater or equal to given conc.

B_{LO}= Breakpoint concentration smaller or equal to given conc.

I_{HI} = AQI value corresponding to B_{HI}

I_{LO} = AQI value corresponding to B_{LO}

Finally;

AQI = Max (Ip) (where; p= 1,2,...,n; denotes n pollutants)

The breakpoint concentration table and AQI value corresponding to breakpoints are given below: (units: µg/m^3 unless mentioned otherwise)

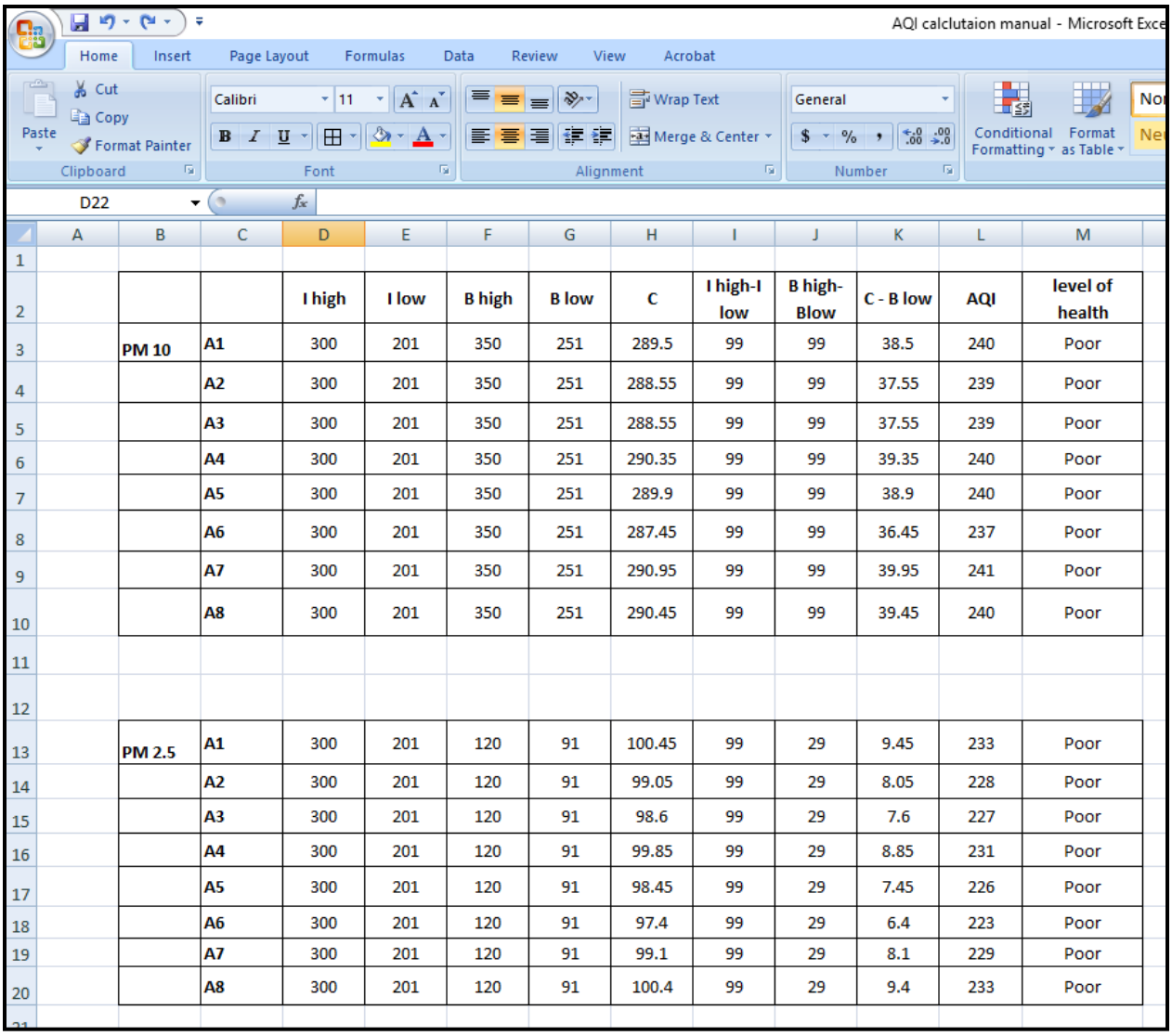
Table3.7: Breakpoint of AQI

AQI Category (Range)	PM_{10} 24-hr	$PM_{2.5}$ 24-hr	NO_2 24-hr	O_3 8-hr	CO 8-hr (mg/m^3)	SO_2 24-hr	NH_3 24-hr	Pb 24-hr
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.6 –1.0
Moderate (101-200)	101-250	61-90	81-180	101-168	2.1- 10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10.1-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748*	17.1-34	801-1600	1201-1800	3.1-3.5
Severe (401-500)	430 +	250+	400+	748+*	34+	1600+	1800+	3.5+

AQI Value corresponding to Breakpoints

Breakpoint range (B_{HI}-B_{LO})

Calculation sheet for AQI is shown below:



			I high	I low	B high	B low	C	I high-I low	B high-Blow	C - B low	AQI	level of health
PM 10	A1		300	201	350	251	289.5	99	99	38.5	240	Poor
	A2		300	201	350	251	288.55	99	99	37.55	239	Poor
	A3		300	201	350	251	288.55	99	99	37.55	239	Poor
	A4		300	201	350	251	290.35	99	99	39.35	240	Poor
	A5		300	201	350	251	289.9	99	99	38.9	240	Poor
	A6		300	201	350	251	287.45	99	99	36.45	237	Poor
	A7		300	201	350	251	290.95	99	99	39.95	241	Poor
	A8		300	201	350	251	290.45	99	99	39.45	240	Poor
PM 2.5	A1		300	201	120	91	100.45	99	29	9.45	233	Poor
	A2		300	201	120	91	99.05	99	29	8.05	228	Poor
	A3		300	201	120	91	98.6	99	29	7.6	227	Poor
	A4		300	201	120	91	99.85	99	29	8.85	231	Poor
	A5		300	201	120	91	98.45	99	29	7.45	226	Poor
	A6		300	201	120	91	97.4	99	29	6.4	223	Poor
	A7		300	201	120	91	99.1	99	29	8.1	229	Poor
	A8		300	201	120	91	100.4	99	29	9.4	233	Poor

Figure3.5: Screenshot of AQI Calculation sheet

3.7 DESCRIPTION OF THE MODELING SYSTEM

In this study, the model has been setup for calculation of 8 hourly average concentrations of Co, 8 hour for Sox, 24 hourly averages for SPM, and NO_x and total suspended solid using urban dispersion option.

3.7.1 AERMET Meteorological Data Processing:

The surface and upper air data were processed with AERMET along with the output from the AERSURFACE processing.

The preparation of the meteorological data files using AERMET was a two-step process. The First step was the extraction of raw hourly surface observations and upper air soundings. The Extracted files were checked by AERMET module for consistency and any missing or calm Hours were identified.

The second step was to read the meteorological data and estimate the boundary layer parameters required by AERMOD using land use surface parameters unique to the area surrounding the project site.

3.7.2 LAND USE ANALYSIS:

Land use analysis was done by GIS team of Vardan Environet using software ARC GIS -10.0. The land use pattern of 10 Km study area is given as **Table-3.8: Land Use Pattern**

Table3.8:Land use pattern of study area

Land Use/ Land Cover	Area (In Ha)	% Area
Agriculture	7297	23.2
Settlement	11896	37.9
Water Body	16	0.1
Open Scrub	9910	31.5
Fellow Land	1886	6.0
Industry	409	1.3
TOTAL	**31414 Ha**	**100 %**

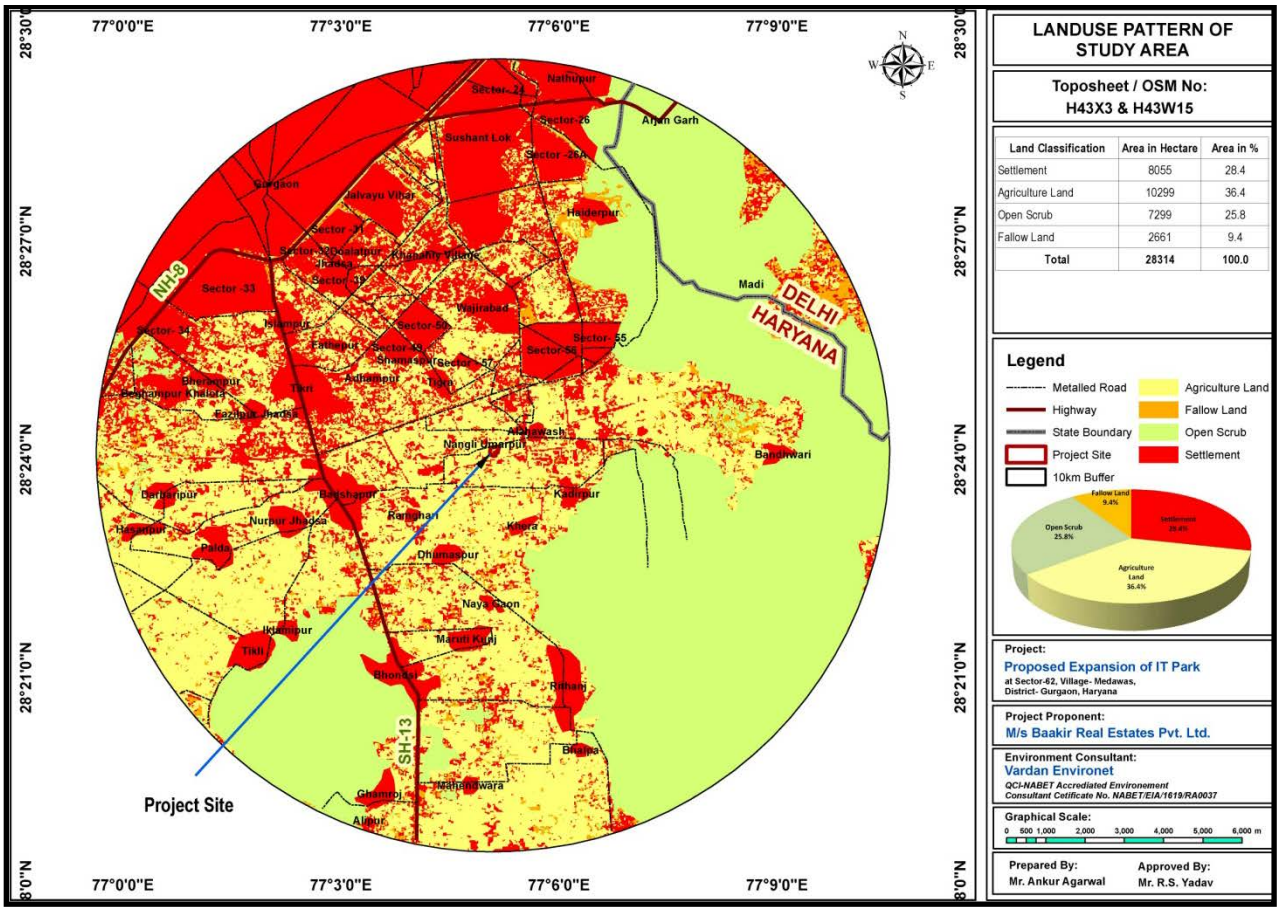


Figure3.6: Land Use Pattern around 10 km of the Project Site

3.7.3 SELECTION OF THE METEOROLOGICAL DATABASE

Excel sheet for metrological data was prepared taking secondary data from IMD. IMD data for IGI (Indira Gandhi International Airport) during the post monsoon period was taken which is approximately 17 Km away from project site.

3.7.4 AERMOD PROCESSING

The AERMOD model was used with regulatory default options as recommended in the EPA

Guideline on Air Quality Models as listed as follows:

- Use stack-tip downwash
- Model accounts for flat terrain effects
- Use calm processing

- Use sequential meteorological date checking
- Use of the PRIME algorithm for sources influenced by building downwash
- Use Missing Data Processing routine
- No exponential decay calculated

3.7.5 AERMOD INITIALIZATION

In the study, AERMOD model from Lakes & Environment was initialized. 1st October 2017 to 31st December 2017(post monsoon season) was considered the study time period. For cumulative ground level concentration of CO, PM, NO_x and SOx 10 Km area from project boundary is considered as the study area. 3 point sources at project site are marked and whole study area is considered as the receptor. Flat terrain and urban pattern without its downwash effects is considered for simulation of model. In the following subsections emission data, source & receptors data is specified. Land use pattern, metrological data used as input to model is also given here.

3.7.6 EMISSION SOURCES AS MODEL INPUTS

The emission sources for input of this software are calculated as per EPA standards. Three point sources i.e. stack of DG sets proposed at the site is considered as the prime source of pollution. Emission rates of these pollutants was first calculated and then input along with other information required about sources. Other specified details are GPS coordinates of source, emission velocity, gas exit temperature and diameter of the stack. Here in this study, all other parameters are taken as standards followed by EPA.

Project site is having provision for 3 DG sets of total capacity of 2000 KVA (1 x 250 + 1 x 750 + 1 x 1000 KVA) during construction phase which is considered as the point source of calculating ground level concentration. During construction phase 8-10 hr operation of DG sets is considered, for which emission standards has been used. Fuel consumption is calculated as per capacity of DG sets.

Proposed height of stack is calculated as per CPCB norms. Formula for calculating minimum stack height is given as:

$$\boldsymbol{H = h + 0.2\sqrt{KVA}}$$

Where, h= Height of building in meter

H= Total height of stack in meter

KVA= Capacity of DG sets in KVA

3.7.7 RECEPTORS

For predicting ground level concentrations, we input co-ordinates of receptors where we wish to predict the concentration. Here, 10 km study area is considered as the receptor. Uniform Cartesian grid is taken as receptor (180 receptors) for 10 km area around project site.

3.7.8 METEOROLOGICAL CONDITIONS AS MODEL INPUTS

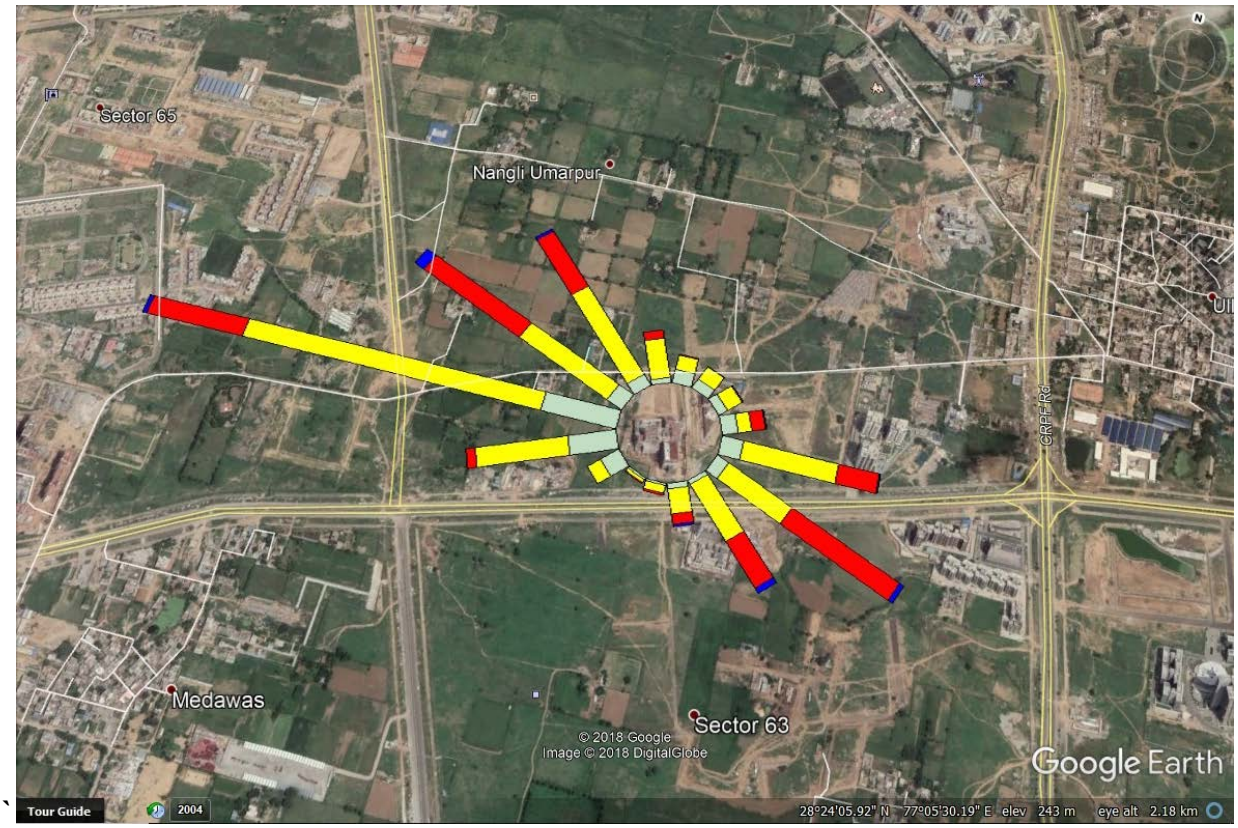


Figure3.7: Windrose diagram at Google image

Windrose diagram is prepared by giving meteorological inputs for AERMOD. AERMET is the pre processor of this software which calculates the boundary layer parameter. Metrological data

is necessary for Aermod which is generated by AERMET. Inputs provided to this pre processor are wind speed, wind direction, cloud cover, temperature, pressure and mixing height on hourly average.

After giving all the necessary inputs required by the software we RUN the AERMOD software to get the desired isopleths and maximum concentration of pollutants dispersed.

CHAPTER-4

RESULTS:

After studying EIA in detail, it can be conclude that EIA has turned to be one of the most successful tools of this 20th century for sustainable development. EIA has proved successful in predicting impacts and further for decision making for a project to get clearance or not.

In addition to this, EIA has many imperfections which can be overcome for the betterment of its process. Inadequate knowledge about the project, no site visits, no cross verification of report and insufficient data and especially there is no provision for proper monitoring and analysis of baseline data makes this process just a legal formality. Environment management plan are rarely followed after completion of construction process.

4.1 Impacts from construction activity:

As discussed, Impacts are analyzed by checklist matrix which includes all social, economic, and other impacts

Table 4.1: Impact Matrix

Environmental Parameters	Nature of Potential Impacts during Construction and Operational							
	Local	Regional	Short Term	Long Term	Reversible	ble	Adverse	Beneficiaries
Topography	√							
Drainage	√							
Soil	√							
Water Resources	√	√	√		√		√	
Water Quality	√			√				
Land Use	√			√		√		√
Air Quality	√	√		√	√		√	
Noise	√	√			√		√	

Flora	√					√		√
Fauna	√					√		√
Employment	√	√		√		√		√
Aesthetic	√	√		√		√		√

4.2 AQI RESULTS:

Data obtained after ambient air monitoring at different location is used to calculate AQI. The result obtained from the calculation of Air quality index (AQI) at each location shows the air scenario of project site and 10 Km study area from project. AQI results are given below in the table:

Table 4.2: Result of AQI location wise

Parameter	**AQI of Location**							
	A1(Project site)	A2	A3	A4	A5	A6	A7	A8
PM10	240	239	239	240	240	237	241	240
PM2.5	233	228	227	231	226	223	229	233
SO2	14	15	15	17	14	13	13	14
NO2	39	39	34	37	40	39	39	36
Overall AQI	**240**	**239**	**239**	**240**	**240**	**237**	**241**	**240**
Level	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor

AQI results are obtained are more or less in similar category and AQI vary between 237 to 241 which falls under “Poor” category. It shows that air has unhealthy affect on human; it can be responsible for serious respiratory and cardio diseases on all age group of people. This study declares that PM_{10} is the dominant pollutant in AQI.

This could be because study conducted is in winter season (October-December), where dispersion of pollutants is least as mixing height is less. This study period also includes Diwali festive and stable burning in Punjab, Haryana which was major reason for poor air quality of

NCR. Further construction activities in Gurugram is increasing and frequent dust storms results in poor quality of air.

4.3 PREDICTED GROUND LEVEL CONCENTRATION:

Incremental ground level concentration from the study shows the different results for parameters studied. Maximum predicted concentration of Sox, Nox, CO, SPM is 1.46 $\mu g/m^3$, 4.38 $\mu g/m^3$, 4.7 $\mu g/m^3$, 1.60 $\mu g/m^3$.respectively.

From the above study we observed that

- Concentration of Nox and SPM is due to new versions of the diesel engine, which have the pre-chamber and the combustion chamber. Combustion chambers are modified to the maximum combustion rate so higher the combustion rate lower the emission rate and higher fuel efficiency and max power output from the DG Sets. New version DG sets are digitally controlled i.e. controlled fuel injection rate which results in reduction of exhaust emission.
- The Nox emissions are controlled by Exhaust Gas Re-circulation (EGR) and Selective catalytic reduction (SCR)
- Sox concentration is very less this is because fuel used for DG Sets is High Speed Diesel (HSD) which has only 0.05 % sulpher content in it.

4.4 CUMULATIVE GROUND LEVEL CONCENTRATION:

Cumulative GLC is summation of baseline concentration obtained from manual monitoring and by predicting incremental air results which are given below in table:

Table 4.3: Cumulative GLC at project site

Village	Max Baseline Concentrations				Predicted GLC – ISCST3				Cumulative GLC			
	SPM (µg/ m^3)	NO_2 (µg/ m^3)	SO_2 (µg/ m^3)	CO (mg/ m^3)	SPM (µg/ m^3)	NO_2 (µg/ m^3)	SO_2 (µg/ m^3)	CO (mg/ m^3)	SPM (µg/ m^3)	NO_2 (µg/ m^3)	SO_2 (µg/ m^3)	CO (mg/ m^3)
Project Site	310.5	31.3	11.4	2.1	1.60	4.38	1.46	4.78	312.10	35.78	12.86	6.88

In this study, the efficiency of AERMOD in predicting pollutant concentrations at various time scales in a study area was evaluated. These results are useful to researchers who desire to use AERMOD as a modelling tool for population exposure assessment at different time scales.

While the results are interesting, we believe the results can be improved when more input data become available. For instance, in this study, only point emissions (DG Sets) in the study area were considered as the pollution sources. On analyzing the GLC obtained, it can be observed that pollutants although dispersed, but still higher concentration from environment point of view.

However, measurement uncertainties (e.g., tracer detection limitations) may have influenced the accuracy of model evaluation. Other model parameters, such as building locations and heights, will also have an effect in concentrations in the area. But building wake effects were not taken into account in the simulations because it is very time consuming to produce historical building data. Other parameters, such as dispersion delay and photo-chemistry effects, which were not considered in this study, could also influence the results.

Furthermore, emission rate calculation was based on standards from EPA manual, it may vary from results obtained from manual monitoring of DG Sets which can make huge difference in maximum ground level concentration.

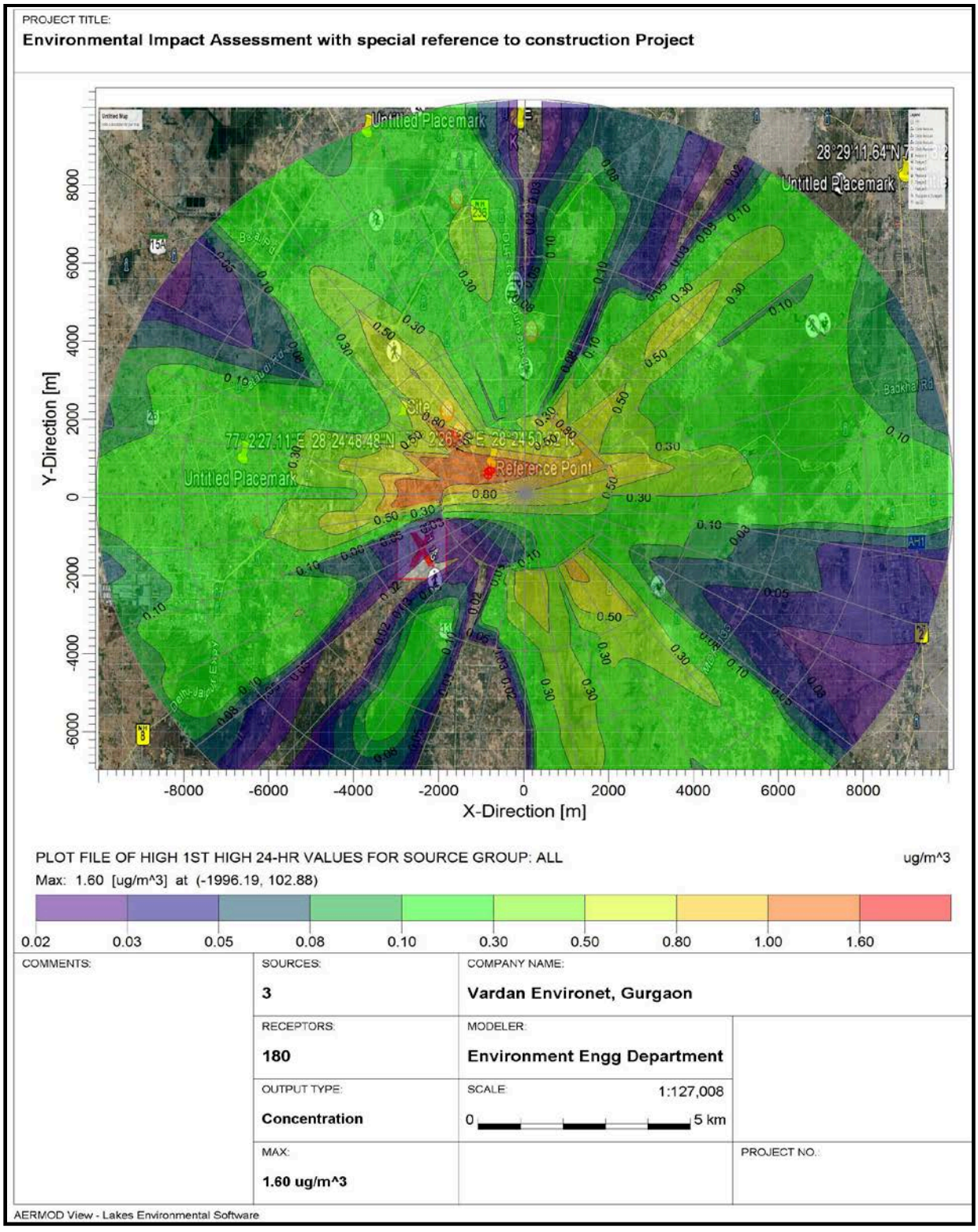


Figure 4.1:Isopleth of SPM showimg maximum concentration

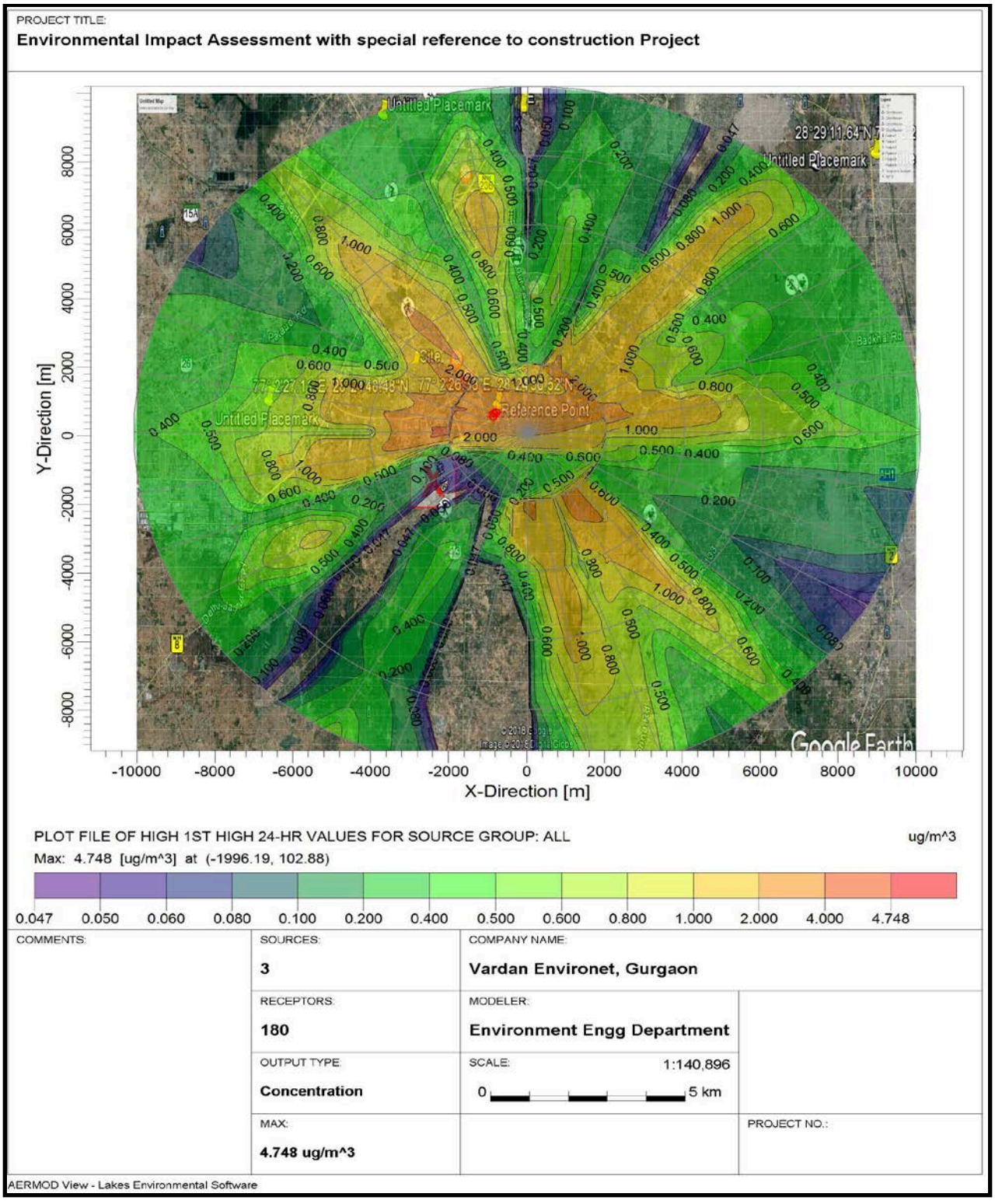


Figure4.2: Isopleth of CO showing maximum concentration

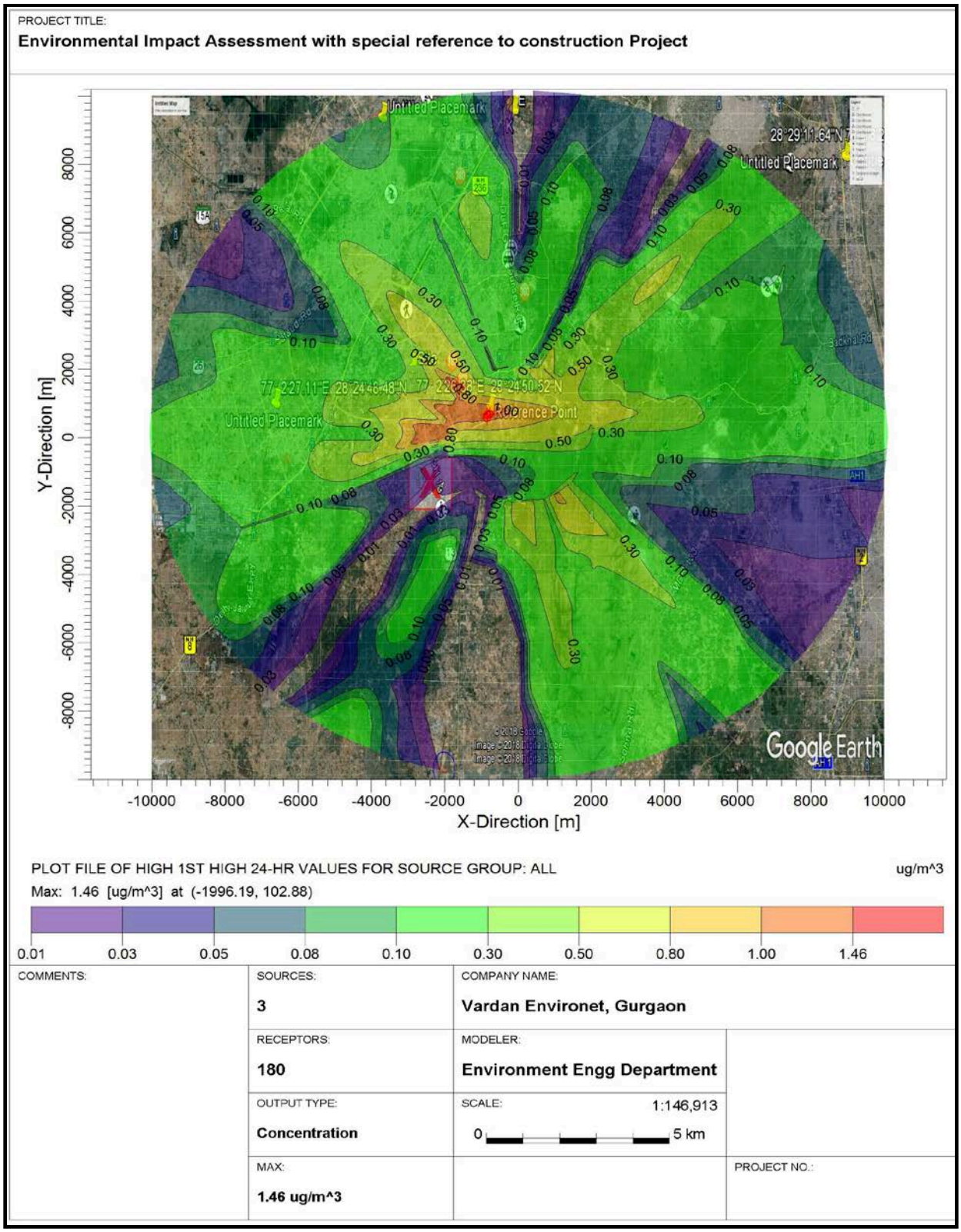


Figure4.3: Isopleth of SO_2 showing maximum concentration

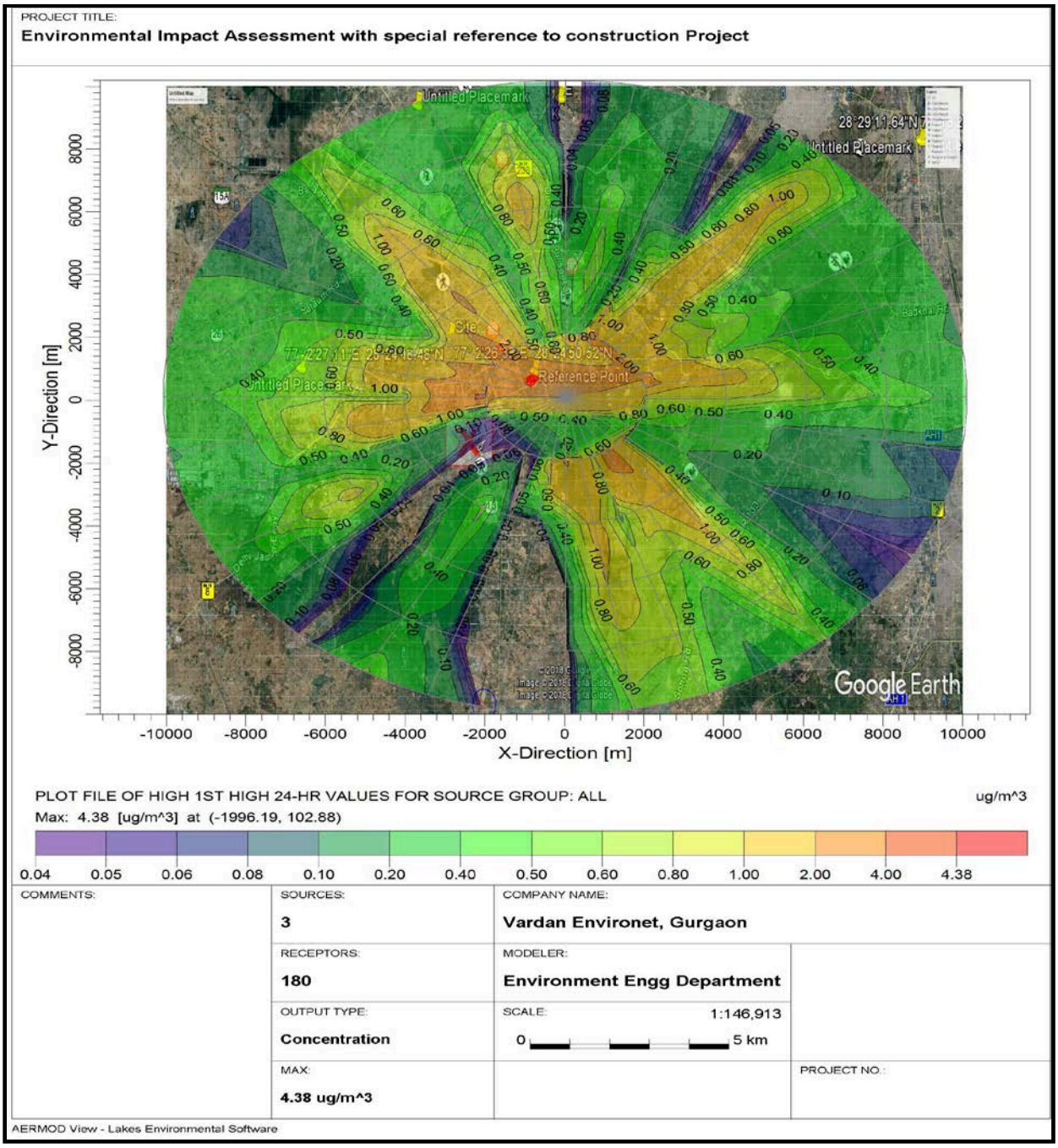


Figure 4.4: Isopleth of NO_2 showing maximum concentration

CHAPTER-5

CONCLUSION

- EIA is important decisive making tool for giving clerence to project but Environment protection agency must be more careful and precise about the study conducted by the consultants.
- Air quality of Gurugram is “very poor” as per AQI results, for which construction activities is one of the major resons. Short term impacts are anticipated from any construction project.
- Impacts anticipated from these activities need to be minimized by using alternative techniques and incorporating appropirate mitigation measures.
- Air dispersion and cummulative ground level concentration is helpful to understand the future impacts of construction on air

CHAPTER-6

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Annexure-1

		I high	I low	B high	B low	C	I high-I low	B high-Blow	C - B low	AQI	level of health
PM 10	**G1**	200	100	250	101	184.77	100	149	83.77	156	Moderate
	A1	300	201	350	251	289.5	99	99	38.5	240	Poor
	A2	300	201	350	251	288.55	99	99	37.55	239	Poor
	A3	300	201	350	251	288.55	99	99	37.55	239	Poor
	A4	300	201	350	251	290.35	99	99	39.35	240	Poor
	A5	300	201	350	251	289.9	99	99	38.9	240	Poor
	A6	300	201	350	251	287.45	99	99	36.45	237	Poor
	A7	300	201	350	251	290.95	99	99	39.95	241	Poor
	A8	300	201	350	251	290.45	99	99	39.45	240	Poor

PM 2.5	**G1**	300	201	120	91	95.36	99	29	4.36	216	Poor
	A1	300	201	120	91	100.45	99	29	9.45	233	Poor
	A2	300	201	120	91	99.05	99	29	8.05	228	Poor
	A3	300	201	120	91	98.6	99	29	7.6	227	Poor
	A4	300	201	120	91	99.85	99	29	8.85	231	Poor
	A5	300	201	120	91	98.45	99	29	7.45	226	Poor
	A6	300	201	120	91	97.4	99	29	6.4	223	Poor
	A7	300	201	120	91	99.1	99	29	8.1	229	Poor
	A8	300	201	120	91	100.4	99	29	9.4	233	Poor

SO2	**G1**	50	0	40	0	6.32	50	40	6.32	8	Good
	A1	50	0	40	0	11.45	50	40	11.45	14	Good
	A2	50	0	40	0	12.25	50	40	12.25	15	Good
	A3	50	0	40	0	11.6	50	40	11.6	15	Good
	A4	50	0	40	0	13.2	50	40	13.2	17	Good
	A5	50	0	40	0	11.15	50	40	11.15	14	Good
	A6	50	0	40	0	11.15	50	40	11.15	14	Good
	A7	50	0	40	0	10.5	50	40	10.5	13	Good
	A8	50	0	40	0	11	50	40	11	14	Good

NO2	**G1**	50	0	40	0	21.75	50	40	21.75	27	Good
	A1	50	0	40	0	30.9	50	40	30.9	39	Good
	A2	50	0	40	0	31.5	50	40	31.5	39	Good
	A3	50	0	40	0	27.55	50	40	27.55	34	Good
	A4	50	0	40	0	29.95	50	40	29.95	37	Good
	A5	50	0	40	0	31.9	50	40	31.9	40	Good
	A6	50	0	40	0	27.95	50	40	27.95	35	Good
	A7	50	0	40	0	30.9	50	40	30.9	39	Good
	A8	50	0	40	0	28.6	50	40	28.6	36	Good