

Organized for Maharashtra Pollution Control Board (MPCB)



Maharashtra Pollution Control Board

महाराष्ट्र प्रदूषण नियंत्रण मंडळ

by Ekonnnect Knowledge Foundation in partnership with SDG Foundation



Supported by



REPORT ON AQM TRAINING

05 & 06 October 2017



Group Photo at the opening ceremony

About Ekonnnect Knowledge Foundation

Set up in 2012, Ekonnnect is a non-profit company offering awareness, education and counsel Environmental Management & Sustainability. Engaging with stakeholders ranging from university students, young professionals and educational institutions, to government bodies and corporate, Ekonnnect has successfully delivered a range of training services including face-to-face and blended training programs with e-learning, Training of Trainers (ToT), curriculum design and career counseling in the domain of environmental management and sustainability. For more information please visit to - www.ekonnnect.net .

About SDG Foundation

SDG-Foundation is a Think-tank to develop dialogue to enhance the global partnership sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the SDGs in developing countries, involving Regulators, Civil society and Corporate. The idea is to bring into focus the scientific expertise and technological advancement for solving issues relating to Environment and Sustainable Development. The objective is to be a Strategic Think Tank for creating a framework for integrating social and business values. For more information please visit to - www.sdg-foundation.org

About BREEZE

BREEZE®, a division of Trinity Consultants provides the market-leading air dispersion, fire, explosion, and risk assessment modeling software which are used by over 4,000 professionals in industry, regulatory agencies, and academia in over 90 countries around the world.

BREEZE offers BREEZE AERMOD which is an enhanced version of the US EPA-approved AERMOD that provides modelers with the tools and functionality needed to perform air quality analyses. BREEZE also provides quality assured, model-ready meteorological and geophysical data in a variety of formats for use in modeling studies, as well as professional training and high-speed parallel modeling services for AERMOD. In India, Environmental Management Centre LLP is the partner. For more information please visit to - www.breeze-software.com

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Acknowledgement

We acknowledge with gratitude the encouragement and support received from Member Secretary and Officers of the Maharashtra Pollution Control Board (MPCB), who made this training program a success.

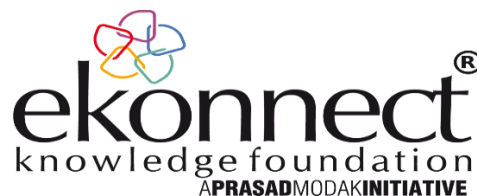
Special thanks go to Dr. V.M. Motghare, Joint Director (APC), MPCB, who facilitated the entire process and provided necessary support and guidance.

We are also thankful to our trainers Dr. Prasad Modak, Mr. Vishwa Vijaysheel, Mr. Urv Patel, Dr. Santosh Kulkarni and Mr Yogesh Sathe who contributed sessions during the training.

Last but not the least, we owe a large part of our success to the active involvement of all the participants who worked under a rather tight schedule and made the training program an enriching process.

Dr. Shrikar Dole
Founder & CEO
SDG Foundation

Dr. Prasad Modak
Director
EkonnnectKnowledge Foundation



Summary

Air pollution has become a public health issue and with significant economic implications. There are increasing numbers of people who die prematurely every year with the increasing air pollution levels. Deaths due to air pollution are only a fraction less than the number of deaths caused by tobacco usage.

Global Burden of Disease (GBD), a comprehensive regional and global research program, has estimated that 3283 Indians died per day due to outdoor air pollution in 2015.

On the economic front, loss of productivity, material damage and the forced closures of schools and industries have already started impacting our economy. The World Bank estimates that India loses around 3% of its GDP due to air pollution. In the last few years, there has been a renewed focus on improving air quality, though legislative and court mandated action. Poor capacity in Air Quality Management (AQM) of concerned institutions has however been a critical issue.

The goal of this training program is to provide advance training on methodologies and tools for air quality management to the field formation of Maharashtra Pollution Control Board (MPCB) and to encourage discussion and debate on various aspects of air pollution and its impact on air quality, health and climate.

It is expected that after this training, access to software tools and hands-on practice, the participants are equipped to carry out Data analysis and Modeling to prepare Air Quality Management Action Plans.

Introduction

In recent times, Air Pollution Control (APC) has drawn attention of the regulators at the National as well as State level. Emission regulations for industries and vehicles and National Ambient Air Quality Standards have an important role to play in improving ambient air quality.

In order to help take control actions and communicate the air quality data to citizens, the regulatory authorities have issued stringent directives to Industries and Urban Local Bodies (ULBs), for automated monitoring of emissions as well as ambient air quality.

Unfortunately, despite these efforts, there has been moderate progress and/or accomplishment on the ground and the air pollution levels in cities and around industrial areas have been found to be at alarming levels. The actions taken have been rather piecemeal and a “systems approach” to AQM is missing.

Poor understanding of the integrated approach and weak institutional capacities are some the major bottlenecks.

In order to address this issue on a programmatic basis, MPCB organized a 2 day training program for its Field Officers (FO) targeting on AQM. The focus of the program was on data analytics, air quality modeling and preparation of air quality management plans. The program was conducted in an interactive manner building on the participants’ expertise and experience.

Twenty two FOs, who are involved directly or indirectly in Air Pollution Control in the State, were trained. The program was jointly organized by Ekonnnect Knowledge Foundation in association with SDG Foundation. The program was held at the ITC Grand Central in Mumbai, on Thursday 5th and Friday 6th October 2017.

All registered participants received access to a dashboard for air quality data analytics (www.environmentalanalytics.co) and a trial license (valid till 15th November 2017) of the suit of BREEZE AERMOD software for dispersion modeling.

This report documents the proceeding of the training program. Annex 1 describes the various sessions conducted, Annex 2 provides list of participants, Annex 3 presents the feedback analysis, Annex 4 & 5 are the exercises provided to participants to hone their skill, post training.

Opening Session



Dr. Shrikar Dole, founder & CEO welcomed Dr. P. Anbalgan, IAS, Member secretary; Dr V.M. Motghare, Joint Director (APC) and all the participants. He stated that the Board's strong commitment to capacitate its staff is reflected by the presence of its senior administration at the inaugural session.

Member Secretary in his inaugural address informed the participants that the Central Pollution Control Board (CPCB) has identified 17 cities in the State of Maharashtra for the preparation of the Action Plans. Preparation of these action plans require application of various tools of data analytics and an exposure to air pollution dispersion modelling.

Dr. P. Anbalgan also stated that recently, the Chief Minister of Maharashtra has launched "Clean Air Mission Maharashtra 2022". In view of this launch the current training assumes a special significance for the participants. In closing, he thanked the organizers and appreciated that the program involved a blend of theory, case studies and hands-on sessions. He wished the program a success.



Joint Director (APC) in his address stated that air pollution due to natural as well as anthropogenic phenomenon and meteorological conditions further aggravate the severity of air pollution. He stressed that the improvement of air quality requires a multi-disciplinary and integrated approach. Continuous monitoring and a good management (action) plan are prerequisite towards achieving improvement of the air quality on sustained basis.



Dr. V. M. Motghare informed the participants about the various innovations in the field by the board such as Emission Trading scheme, Maharashtra Star Rating Program and facility of Environmental Care Center at the HO. He

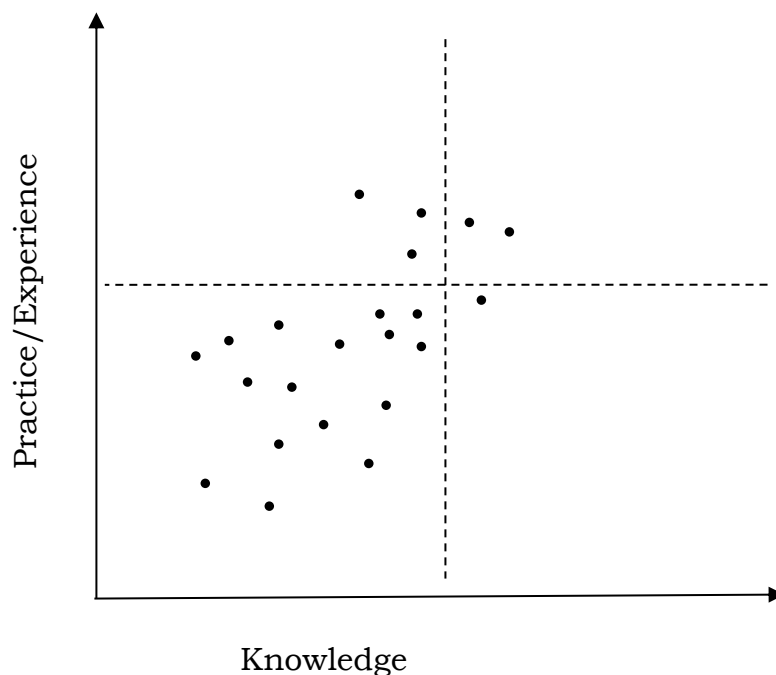
requested the organizers to support participants after the conduct of training to hone their skills through assignments.

Dr. Prasad Modak, Director, Ekonnnect Knowledge Foundation (EKF) thanked MPCB for the opportunity and briefed the participants about the structure of the training program for the next 2 days.

Before the start of the session Dr. Modak asked all the participants to identify their level of knowledge and practice skills in the field by putting a dot in 4 quadrants with knowledge on x axis and experience on y axis. Figure 1 shows that most participants were in Quadrant I requiring more basics, more discussions and access to knowledge resources and post training support. This exercise helped to customize the training program in terms of content, delivery and support.



Figure 1 : Mapping of Knowledge and Practice Experience of the Participants



Training Sessions

Introduction to Air Quality Management (Dr. Prasad Modak)

The first session started with a presentation by Dr. Prasad Modak on the topic 'Introduction to Air Quality Management', the presentation started with importance of Air Quality Management in today's world and then the following topics were covered,

Topics covered in the presentation were –

- Impacts of Air pollution in various cities all over the world.
- Economic implications of Air pollution
- A discussion on why managing the air quality is as important as air quality monitoring.
- Fundamentals of Air quality management.
- Integrated strategy for Air Quality Management (4-P approach).
- Link between Air pollution and climate change.
- Who is the Air Quality Manager?

Overview of Key Tools for Analyzing Ambient Air Quality & Meteorological Data with Examples (Dr Prasad Modak)

After the Tea/Coffee break Dr. Prasad Modak started with a presentation on of Key Tools for Analyzing Ambient Air Quality & Meteorological Data.

Topics covered in the presentation were –

- Understanding Monitored Air Quality
- Missing Data
- Outliers
- How do identify outliers?
- Computing Basic Statistics
- What can be inferred from Basic Statistics?
- Correlations
- The time dimension – Forecasting
- Examples of forecasting models
- Air Quality Index

Demonstration of EnvironmentalAnalytics.co (Vishwa Vijaysheel / Dr Prasad Modak)

Dr. Prasad Modak continued with the next topic which was, how 'Data Analytics' can be used to analyze Ambient Air Quality and Meteorological data. Participants were made aware of the purpose behind analyzing the monitored ambient air quality data. An introduction to the Data Analytics Portal developed under the guidance of Dr. Prasad Modak was given, following which a presentation which showcased the utilities of the Portal was shown.

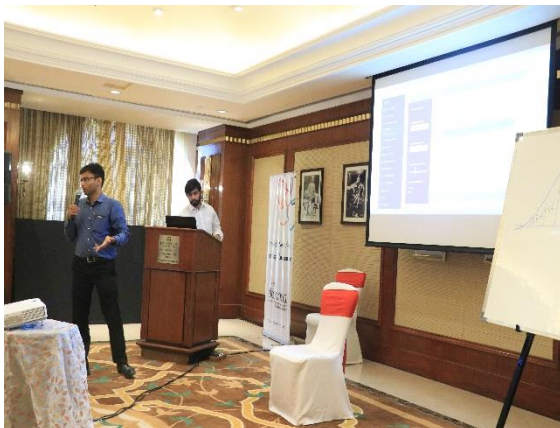


The presentation was followed by a live demonstration of the Air Quality Analytics Dashboard by Dr. Prasad Modak and Vishwa Vijaysheel. A demonstration on the sample dataset was given to the participants of the work flow of the dashboard.

Topics covered in the presentation were –

- Introduction to the website environmentalanalytics.co.
- Air Quality Analytics Dashboard.
- Explanation of the statistical functions used to analyze data in the dashboard.
- Various tools available in on the portal.

Practice Session II (Vishwa Vijaysheel / Urv Patel)



After the lunch break, Practice session 1 began, the participants were divided into groups and a hands-on practice of the Data Analytics portal was initialized. The participants were asked to use the portal and work on the sample dataset available to them, following that they were asked to use various tools and perform functions available to come up with their doubts and questions related to the use of the portal.

Questions raised during Data Analytics Portal demo:

- **What is the format of the dataset which is to be uploaded?**

Answer: The format of the dataset was elaborately explained. The format of the data which is seen on the systems was demonstrated and a detailed explanation of how the dataset be, before uploading onto the portal was given.

- **What are the weights assigned to parameters in calculation of LII?
How can the weights be decided?**

Answer: Weights can be decided based on priority e.g. percentage exceedance or magnitude of exceedance or extent of contiguous violations. For the present version of the dashboard, the weights are assigned equally totaling to 1.

- **Explain time series visualization graph of missing data?**

Answer: The time series graph was explained accordingly with what the 'red' and 'yellow' marks imply. Red bands show individual missing values and yellow band show contiguously missing data for the specifications provided (e.g. 4 contiguously missing values). The inferences to draw from the Missing data time series graph were also discussed.

- **What kind of data was used in the sample?**

Answer: The dataset used was a synthetic dataset created for the purpose of the demonstration.

Practice Session II (Vishwa Vijaysheel / Urv Patel)

The second practice session continued after the Coffee/Tea break. Half an hour of the second session was devoted to demonstrating the downloading process of the software's which was to be used in the following sessions on the next day.

Following the presentations and debrief, the Training-Program was closed for the first day.



Introduction to Gaussian Plume Models (GPM) (Dr Prasad Modak)

Day 2 began with the presentation on 'Introduction to Gaussian Plume Models' by Dr. Prasad Modak, The presentation started by raising two questions to the audience, (1) What is Air quality Modeling? and (2) Why Air Quality Modeling?, followed by a discussion with the participants on the same.

Topics covered in the presentation were –

- Various types of Air Quality Models.
- Assumptions for Gaussian Plume Model.



- Mathematics behind Gaussian Plume Models
- What are the typical inputs and outputs to air quality models?
- Questions that should be asked by a regulator

AERMOD - Theory and Illustrative Applications – Yogesh Sathe, CDAC

Mr. Yogesh Sathe, Environmental Engineer at CDAC, presented Introduction to USEPA AERMOD and its Applications.

Outline of his presentation was –

- Dispersion Modelling Review and Modelling Applications
- Overview of AQM Data Requirements
- Atmospheric Processes
- Classification of Dispersion Models
- Commonly used Air Quality Models
- Modeling Applications
- AERMOD: An Overview
- US EPA AERMOD Modeling System
 1. AERMET
 2. AERMAP



3. AERMOD

- How to prepare Data to run AERMOD?
- Data sources

Mr. Yogesh Sathe elaborated how AERMOD has evolved over the years, how the model structure got improved and how it superseded Industrial Source Complex (ISC) model. He said that while EPA AERMOD is FREE, the model is hard to use for new users and hence Graphical User Interface (GUI) helps such as in BREEZE AERMOD.

Overview of BREEZE AERMOD, Illustrations (Dr Prasad Modak / Urv Patel)

Opening of the next session was by Mr. Urv Patel on the usage of the BREEZE AERMOD.

Topics covered in the presentation were –

- What is BREEZE AERMOD?
- BREEZE AERMOD Capabilities
- BREEZE AERMOD GUI
- Model Run Work Flow
- Setting Projection & Executables

Urv Patel demonstrated use of BREEZE AERMOD with an example. This demonstration consisted the following

- Illustration of two Point Source Emission simulation
- Sample Outputs
- Sensitivity results – Impact on ground level concentrations by changing stack heights, exercising emission control and by changing stack configuration

Linking air quality data, air quality models for action planning (Dr Prasad Modak / Urv Patel)

Dr Modak presented two case studies that showed application of line source dispersion model (CALINE-4) for a highway project and application of ISC-ST for air quality management at Valentina Industrial Estate in Mauritius. The Mauritius case study showed how model was used to assess 7 air quality management options to come up with an implementation strategy.

Introduction to UrbAirIndia - Dr Santosh Kulkarni, CDAC

Dr. Santosh Kulkarni, Engineer, CDAC presented the intent and features of UrbAirIndia– an online decision support system tool developed by CDAC for CPCB.

The topics covered in the presentation included –

- System Overview
- User Access and management



- Data that is already resident
- Projection of Emission Inventory
- Use of Dispersion Model
- Use of Receptor Model for Source Apportionment
- Assessment of Air Quality Management Options

The presentation was followed by a live demonstration of the UrbAirIndia platform.

Frontier Topics and Future Trends – Dr Prasad Modak

The concluding presentation was made Dr. Prasad Modak on the topic 'Frontier Topics and Future Trends'. He touched upon the following topics

- Evolution of Air Quality Monitoring (techniques, parameters and expanse)
- Sensor Technologies
- Emergence of Participatory or Citizen Monitoring
- Involvement of Private Sector especially Build Own Operate Transfer (BOOT) Model
- More use of Meta Data for Decision Making

Closing Session

In the closing session, the presence of Dr. P. Anbalgan, Member Secretary (MS); Dr V.M. Motghare, Joint Director (APC) reiterated MPCB's commitment to ensure the its staff is up-to-date on the development in the field of AQM.



Dr. Shrikar Dole informed MS about what transpired during the two days of the training and informed them that though the 2-day training program is over, the process of engagement with the participants will continue through exercises that the participant's will continue to do this month to ensure that the participants have not only understood

the concepts but will have hands-on practice for effective utilization of the knowledge gained in their day-to-day work.

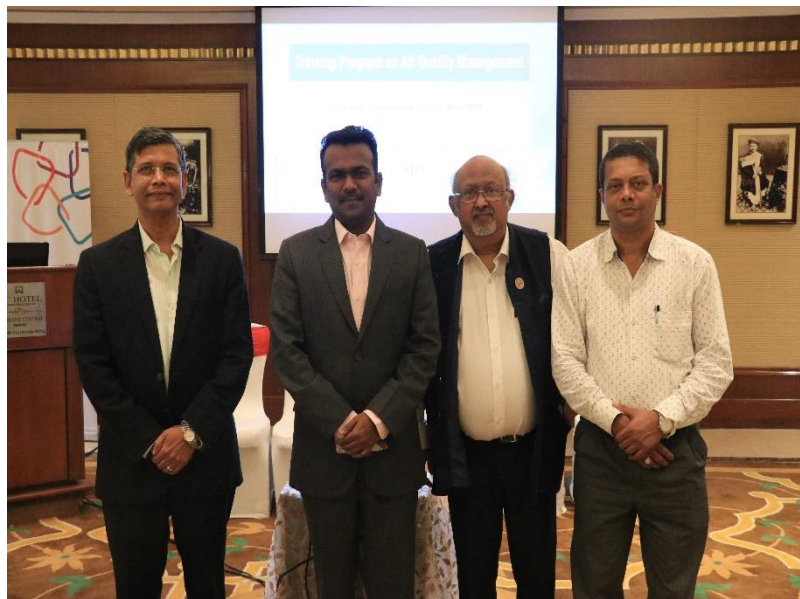
Dr. P. Anbalgan, in his closing remarks reminded the participants about the importance of this training and that he envisages that some of the participants who excel in this post training exercises will be provided the opportunity to further their interest in AQM through further advanced training abroad to enable them to work as Air Quality experts, as they are the next generation of officers, who would have to handle these responsibilities in the Board in future.



Dr V.M. Motghare thanked Member Secretary for proposing the possibility of deputing select participants for advance trainings overseas and exhorted the participants to take advantage of the potential. He urged the participants to take advantage of the various tools, software and resources that are provided in the training program. Finally, he

thanked Ekonnnect Knowledge Foundation and SDG Foundation for their sincere efforts to design and conduct this training.

Dr. Prasad Modak thanked the Member Secretary for providing this opportunity to their young officers and informed that to ensure that the participants continue to use the knowledge gained by providing them with assignments to encourage use of the data tools and software BREEZE AERMOD. The session ended with presentation of certificates to the participants by Member Secretary.



Recommendations as Next Steps

In the limited time of two days the training program attempted to blend overview, theory as well as hands on practice sessions on Air Quality Data analysis & Modeling techniques. It was found that most of the participants were not exposed before to this subject. Hence a follow up in the form of assignments is necessary.

On suggestion of MS, the organizers prepared assignments that the participants could take up. These assignments are included in Annex 4 and 5 to this report. JD (Air) MPCB is requested to transmit these assignments to all registered participants with a deadline for submission. To benefit the participants, the organizers have arranged extension of BREEZE AERMOD license to November 15, 2017.

It is recommended to organize follow up training to provide the participants more detailed exposure on the theory, case studies and hands on experience. To achieve these objectives, two training programs of 2 days each may be carried out - one devoted to Data Analytics using Dashboard and other dedicated to use of AERMOD. This will provide adequate time for learning as well as for practice sessions.

It is also important that such training programs are organized for the industries, academia and professionals with the support of MPCB.

Further, an international training program for 10 select participants may also be designed to learn and experience advances from the US and in the EU (especially Germany).

The Organizers will make proposals for all above for the consideration of MPCB for above.

Annex 1 - Agenda

Training Program on Air Quality Management

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Thursday October 5, 2017

10:00 - 10:10	Inaugural Address by Member Secretary, MPCB (Dr. P. Anbalagan, IAS)
10:10 - 11:00	Introduction to Air Quality Management (Dr. Prasad Modak)
11:00 - 11:15	Tea/Coffee Break
11:15 - 12:15	Overview of Key Tools for Analyzing Ambient Air Quality & Meteorological Data with Examples (Dr Prasad Modak)
12:15 - 13:00	Demonstration of EnvironmentalAnalytics.co (Vishwa Vijaysheel / Dr Prasad Modak)
13:00 - 13:45	Lunch Break
13:45 - 15:15	Practice Session I <ul style="list-style-type: none">• Use of EnvironmentalAnalytics.co and Group work (Vishwa Vijaysheel / Urv Patel)• Data Uploading and Preparation (Missing Values and Outliers)• Data Visualization (Time series)• Data Analyses (Correlation, Trends, Violations)• Processing of Meteorological Data (Wind Rose, Pollution Rose, Persistent Wind Rose, Polar Wind Rose)
15:15 - 15:30	Tea/Coffee Break
15:30 - 16:30	Practice Session II (Vishwa Vijaysheel / Urv Patel)
16:30 - 17:00	Downloading Trial Licence of BREEZE AERMOD
17:00 - 17:15	Close of the Day (Dr Prasad Modak)

Note : Participants are requested to bring their laptops for doing online exercise

Training Program on Air Quality Management



Friday October 6, 2017

10:00 - 10:30	Introduction to Gaussian Plume Models (GPM) (Dr Prasad Modak)
10:30 - 11:30	AERMOD of US EPA - Theory and Illustrative Applications – Yogesh Sathe, CDAC
11:30 - 11:45	Tea/Coffee Break
11:45 - 13:00	Overview of BREEZE AERMOD (Urv Patel / Dr Prasad Modak)
13:00 - 13:45	Lunch Break
13:45 - 15:15	Case Study demonstrating Link between Data, Models and Action Plans (Dr Prasad Modak / Urv Patel)
15:15 - 15:30	Tea/Coffee Break
15:30 - 16:00	Introduction to UrbAirIndia - Dr Santosh Kulkarni, CDAC
16:00 - 16:30	Frontier Topics and Future Trends – Dr Prasad Modak
16:30 - 17:00	Closing session by Mr. Vidyanand Motghare, Joint Director (Air), MPCB

Annex 2 – List of Participants

List of MPCB Officers, nominated for Two Days advanced Training program on Air Quality Management			
Sr. No.	Section/Region	No. of FO	Field Officer Name
1	Sub-Regional Office, Mumbai –I	1	Smt. Jayashri P. Junonkar
2	Sub-Regional Office, Mumbai – IV	1	Shri Sandeep Tope
3	Sub-Regional Office, Thane-II	1	Smt.SuvarnaBaburao Gaikwad
4	Sub-Regional Office, Tarapur-II	1	Shri Amit LaxmanLatey
5	Sub-Regional Office, Kalyan-II	1	Shri AjitRamdasraoSuryawanshi
6	Regional Office Navi Mumbai	1	Shri. UlhasUttamraoKanade
7	Sub-Regional Office, Kolhapur	1	Dr. Rajesh GovindraoAuti
8	Sub-Regional Office, Sangali	1	Shri AnkushRamchandraPatil
9	Sub-Regional Office, Solapur	1	Shri SarjeraoJaysingBhoi
10	Regional Office, Aurangabad	1	Dr. SnehalMadhavraoKose
11	Sub-Regional Office, Jalna	1	Shri.Ravindra G. Kshirsagar
12	Sub-Regional Office, Latur	1	Shri Sharad V. Pawar
13	Sub-Regional Office, Nashik	1	Shri Manish Arun Mahajan
14	Sub-Regional Office, Jalgaon	1	Dr. PrabhakarNagnathWavde
15	Sub-Regional Office, Amravati-I	1	Shri IndrjitDeshmukh
16	Sub-Regional Office, Nagpur-II	1	Shri Manoj Narayan Watane
17	Regional Office, Chandrapur	1	Shri. KushalMagannathAucharmal
18	Regional Office, Raigad	1	Shri NandkumarLomte
19	Sub Regional Office, Pune-II	1	Shri Arvind Dhapate
20	Joint Director (APC)	4	Shri. Sameer Y. Hundlekar
21			Shri Yogesh DilipPatil
22			Smt. Madhurima M. Joshi
23			Shri Salil Save

Annex 3– Feedback Analysis

A questionnaire was administered at the end of the second day of the training program. An analysis of the feedback obtained on this basis is presented below for each question.

1. This training is useful for my work

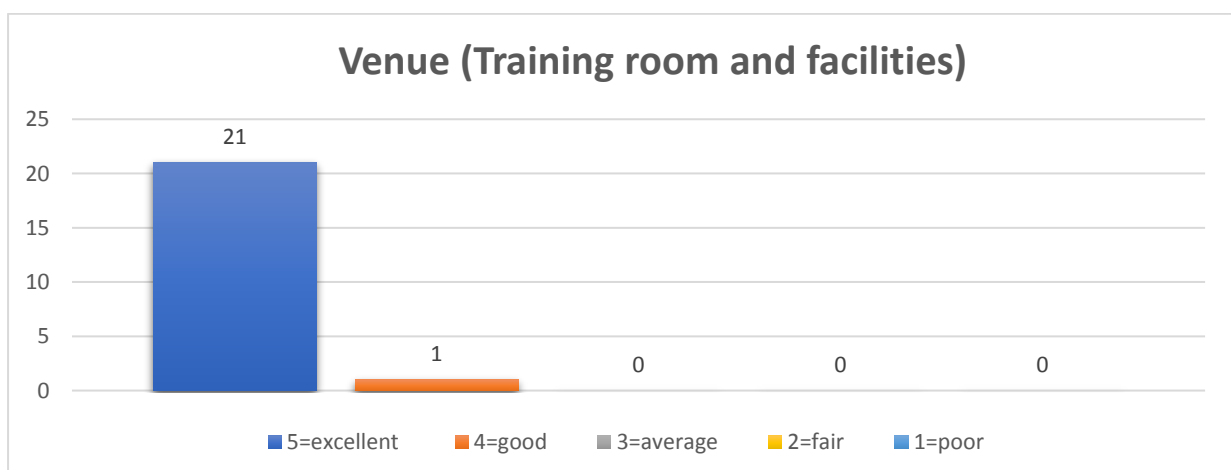
	Yes	No
This training is useful for my work	22	0



100% of the participants stated that the training program is useful for their work, indicating that the Board should continue to capacitate their staff through this program on a continued basis

2. Venue (training room & facilities)

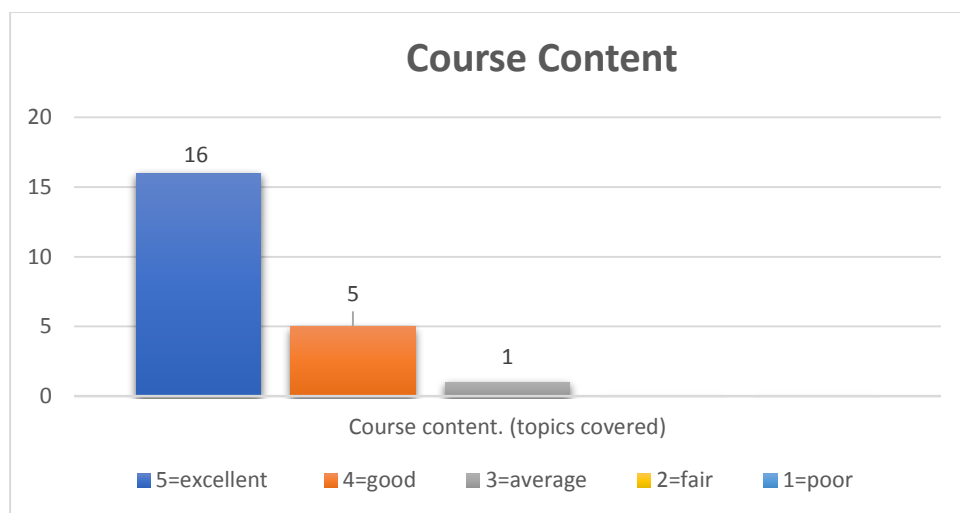
	5= <i>excellent</i>	4= <i>good</i>	3= <i>average</i>	2= <i>fair</i>	1= <i>poor</i>
Venue (training room & facilities)	21	1	0	0	0



The venue was found excellent by practically everybody. There were however issues found related to the speed of internet. This slow speed to access hampered the online practice sessions. In the next events, a dedicated high speed Internet hotspot will be provided rather than depending on hotels facilities or devices such as Geo.

3. Course content. (topics covered)

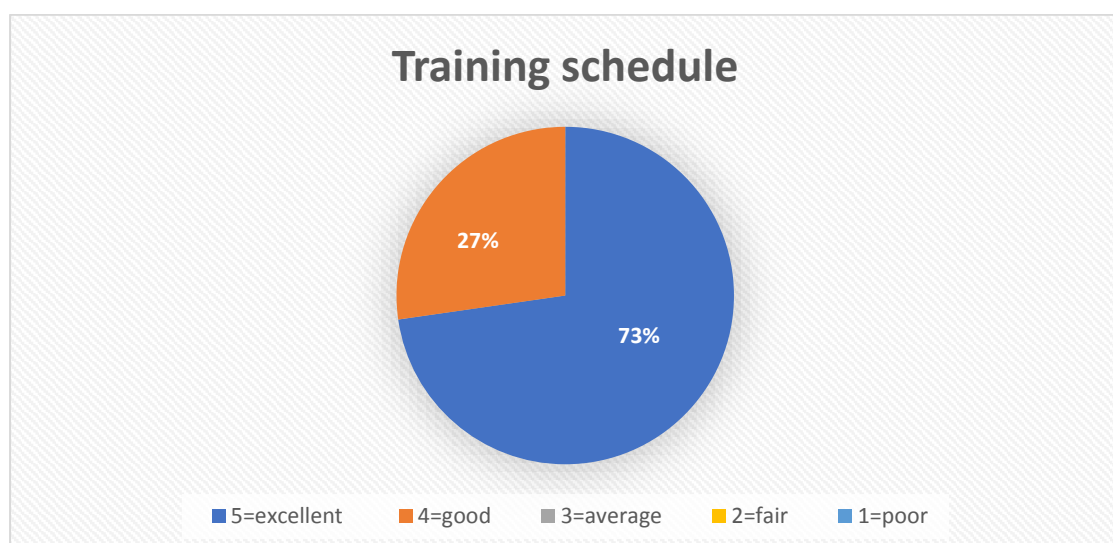
	5= <i>excellent</i>	4= <i>good</i>	3= <i>average</i>	2= <i>fair</i>	1= <i>poor</i>
Course content. (topics covered)	16	5	1	0	0



Majority found the topics covered useful.

4. Training schedule

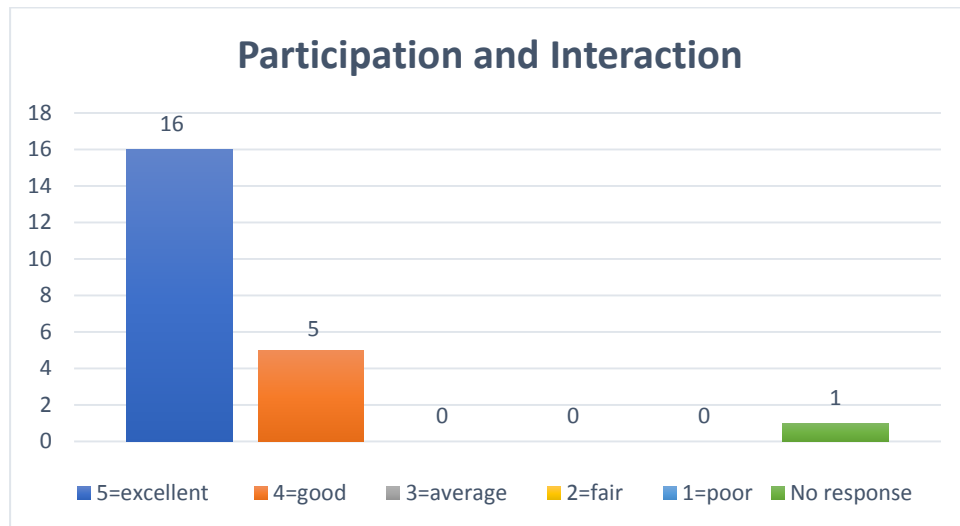
	5= <i>excellent</i>	4= <i>good</i>	3= <i>average</i>	2= <i>fair</i>	1= <i>poor</i>
Training schedule	16	6	0	0	0



Majority found the schedule was tight to cover all the aspects including hands on practice. Hence in future for each subject viz. Data Analytics and Modelling, two days each will have to be devoted. These programs could be spaced.

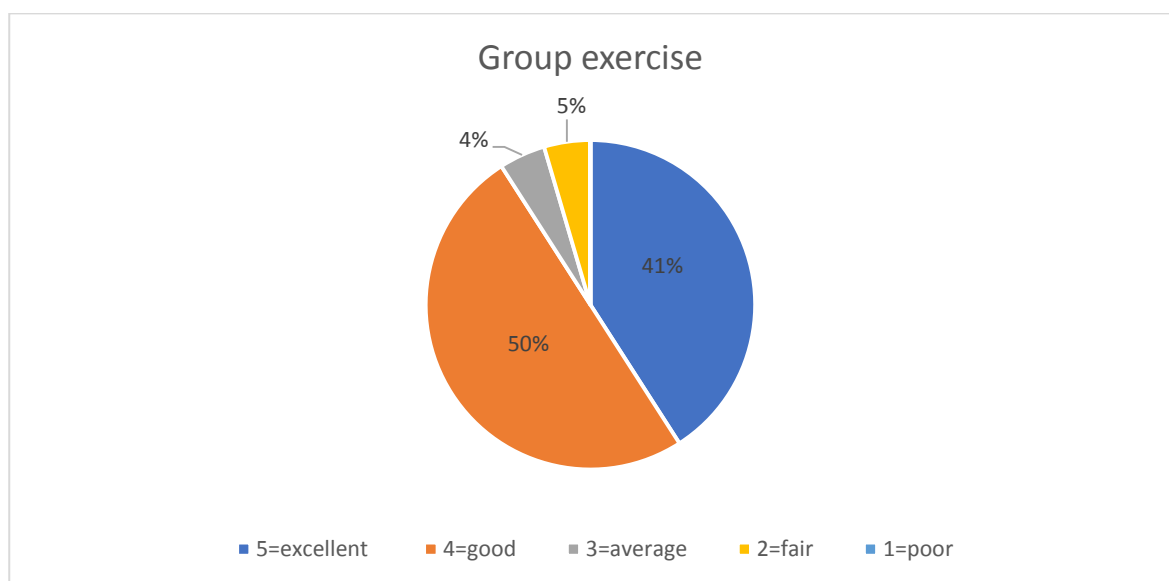
5. Participation & Interaction

	5=excellent	4=good	3=average	2=fair	1=poor	No response
Participation & Interaction	16	5	0	0	0	1



6. Group exercise

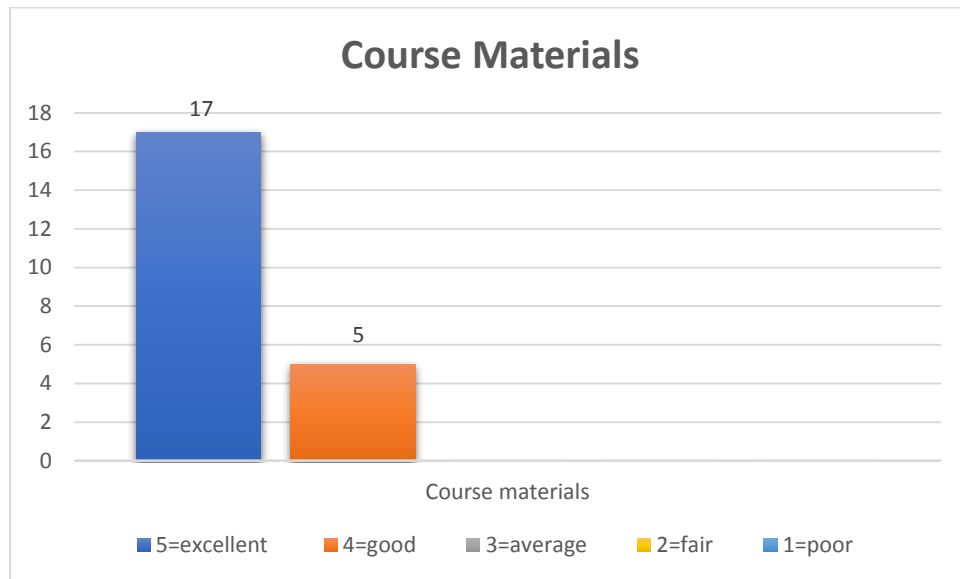
	5=excellent	4=good	3=average	2=fair	1=poor
Group exercise	9	11	1	1	0



A limited time for group exercise was indicated by a significant number of participants, which as explained above was due to lack of time available.

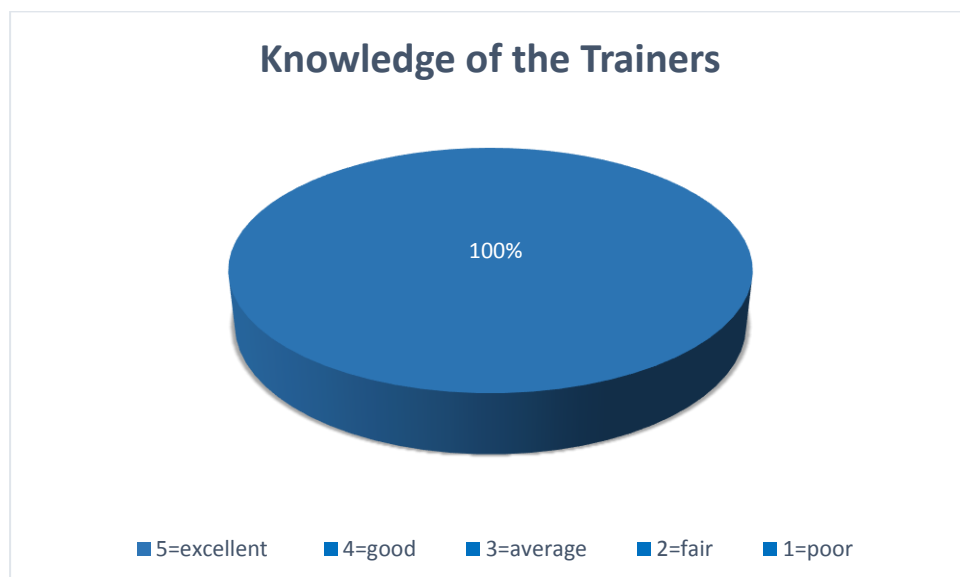
7. Course materials

	<i>5=excellent</i>	4=good	3=average	2=fair	1=poor
Course materials	17	5	0	0	0



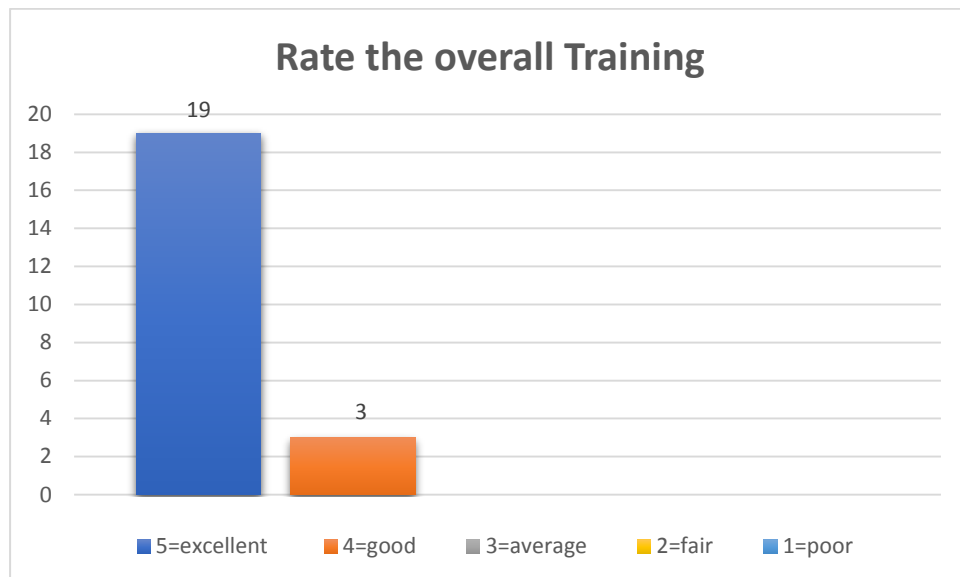
8. Knowledge of the Trainers

	<i>5=excellent</i>	4=good	3=average	2=fair	1=poor
Knowledge of the Trainers	22	0	0	0	0



9. Rate the overall Training

	5=excellent	4=good	3=average	2=fair	1=poor
Rate the overall Training	19	3	0	0	0



The overall rating for program was excellent for almost all the participants. This is thus a very encouraging feedback.

What did you most like about the training?

The responses were varied but were centered on exposure to new aspects about pollutants, Use of software for Data analysis & modeling with output in infographic format. The participants appreciated provision of software, access to the on line dashboard and content provided in pen-drive for practice post the training.

What specifically did the trainers do well?

Again there were different responses but most appreciated the Case Studies, practice sessions and explanation of complex terms in simple language, use of basic concepts and theories, information on Met Data collection, Time management, and interactive nature of the training program.

What in your opinion needs improvement (structure, format, materials)?

The responses largely focused on lack of practice time (due to slow internet speed) and more time for training delivery. Suggestions were made to increase duration even to 4 days with 2 days each dedicated for data analytics and air quality modelling.

Annex 4 – Exercise on Data Analysis

Organized for Maharashtra Pollution Control Board (MPCB)



by Ekonnnect Knowledge Foundation in partnership with SDG Foundation



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Assignment #1

Application of Air Quality Data Analytics

(Created for the Officers of Maharashtra Pollution Control Board (MPCB) who received training on Air Quality Management on October 5 and 6, 2017)

Please follow the Steps as below

Step 1

Access continuous ambient air quality and meteorological data from the station/s of MPCB in your region or jurisdiction

The data should have following parameters on hourly basis.

Hour, Date, Wind speed, wind direction, at least 3 pollutants (e.g. PM10, SO2, NO2)

Data should be available for at least one year

The above data for two continuous monitoring stations will be desirable

Inform Joint Director (Air), MPCB about the station selected and data accessed.

Copy the email to Dr Prasad Modak on prasad.modak@emcentre.com, Vishwa Vijaysheel vishwa.vijaysheel@emcentre.com ; 'Tauseef Farooqui' tausif.farooqui@emcentre.com ; 'Dr. Shrikar Dole' shrikardole@sdg-foundation.org

Step 2

Format the data collected as stated in the air quality analytics dashboard that you were trained

Step 3

Send the data file to Dr Prasad Modak on prasad.modak@emcentre.com with copy to Vishwa Vijaysheel vishwa.vijaysheel@emcentre.com ; 'Tausif Farooqui' tausif.farooqui@emcentre.com ; 'Dr. Shrikar Dole' shrikardole@sdg-foundation.org

You will receive an acknowledgement and you will be contacted if any clarifications are required.

Step 4

Collect latitude and longitude of the station

Take photographs or a video of the monitoring station to get a 360° view.

Collect information on the instrument supplier/instrument make

Obtain data on instrument calibration (frequency and results i.e. deviations/errors) and downtimes

Send the data file to Dr Prasad Modak on prasad.modak@emcentre.com with copy to Vishwa Vijaysheel vishwa.vijaysheel@emcentre.com ; 'Tausif Farooqui' tausif.farooqui@emcentre.com ; 'Dr. Shrikar Dole' shrikardole@sdg-foundation.org

Step 5

Access the Air Quality Analytics Dashboard and analyze the data using all available functions

Export the results in the form of images, tables, PDFs etc. as relevant

Prepare an Air Quality Data Analyses and Interpretation report in MS Word with introduction, table of content and annexures on this basis

The assignment should be completed latest by November 15, 2017 and the report should be sent to **Joint Director (Air), MPCB**

Copy the email to Dr Prasad Modak on prasad.modak@emcentre.com, Vishwa Vijaysheel vishwa.vijaysheel@emcentre.com ; 'Tauseef Farooqui' tausif.farooqui@emcentre.com ; 'Dr. Shrikar Dole' shrikardole@sdg-foundation.org

Annex 5 – Exercise on Data Analysis

Organized for Maharashtra Pollution Control Board (MPCB)



Maharashtra Pollution Control Board
महाराष्ट्र प्रदूषण नियंत्रण मंडळ

by Ekonnnect Knowledge Foundation in partnership with SDG Foundation



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Assignment #2

Application of Aermოდ for Air Quality Impact Assessment

(Created for the Officers of Maharashtra Pollution Control Board (MPCB) who received training on Air Quality Management on October 5 and 6, 2017)

Setting of the Problem

A food industry located in Nagpur City having a wood fired boiler for generating steam for its process application. The industry wants to expand. It plans to expand by commissioning another boiler. The company has proposed to erect another stack (40 m height) near an existing stack (20 m).

As a regulator you want to carry out an air quality impact assessment due to the additional air emissions. Based on application of tool like AERMOD you are expected to advise the industry on the following so that the PM_{10} stays below the permissible limit in the radius of 10 km from the industry:

- Height of the new stack
- Emission rate
- The distance between the two stacks

Due to active citizens of Nagpur, two critical location are identified where there can be the most damage to public health. 1) Air force colony & 2) Sandipani School. Thus, due to public demand, you are also required to calculate relative contribution of both the existing and the proposed stack emissions on these 2 locations.

Input information:

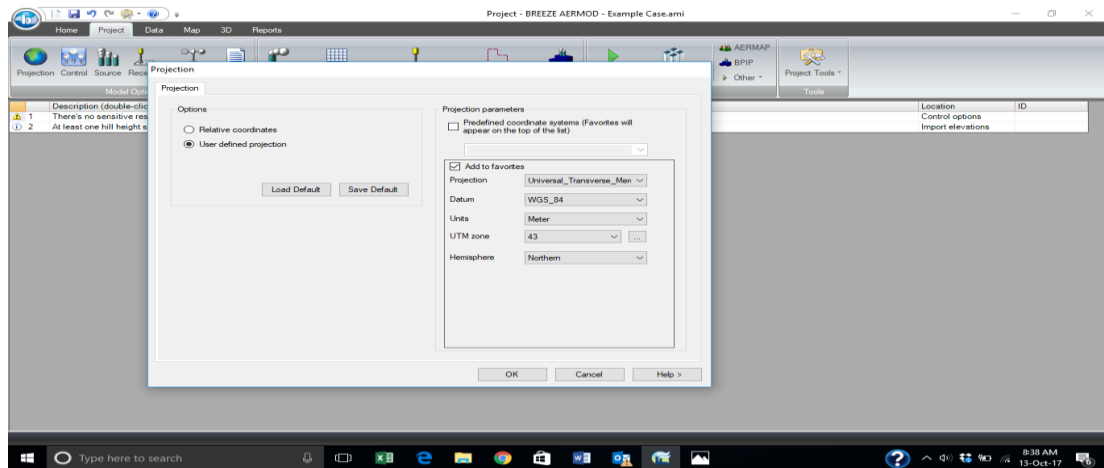
- Important coordinates in UTM
 - Location of the existing stack: 290194.75 , 2341243.18
 - Tentative location of the proposed stack: 290406.56 , 2341161.42
 - Air force colony : 293697.59 , 2341854.98
 - Sandipani School 294983.56 , 2342029.4

- 1 month meteorological file of hourly data is provided with the assignment with an extension .sfc & .plf
- Stack Data:

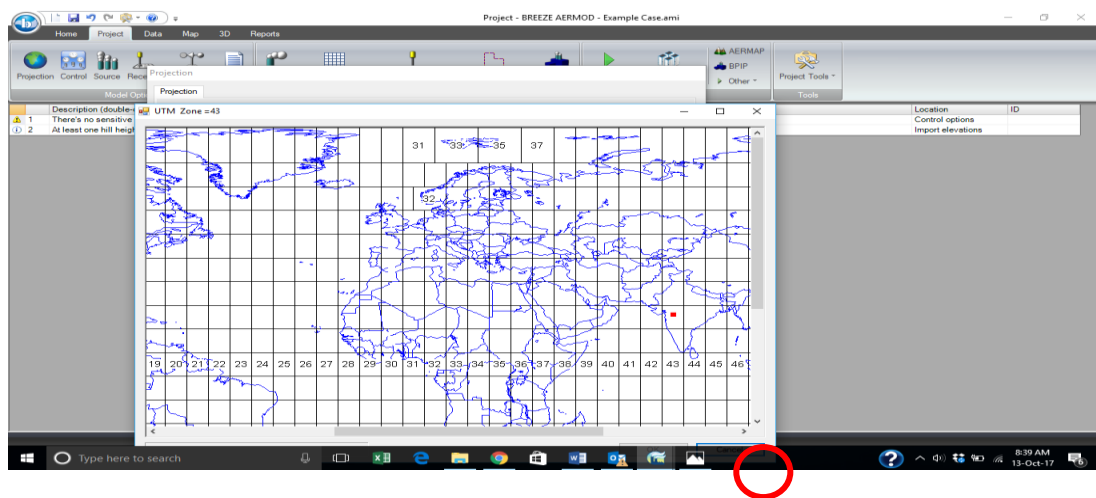
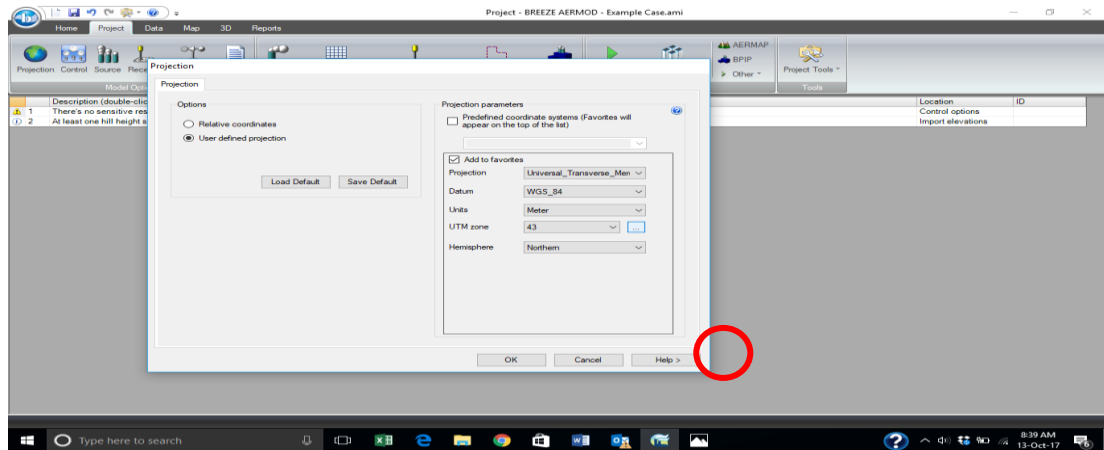
Parameter	Stack-2 (Proposed)	Stack-1 (Existing)
Emission rate	7.25 g/s	7.25 g/s
Stack diameter	0.75 m	0.75 m
Temp of the flue gas	303 K	303 K
Exit velocity m/sec	0.85	0.85
Stack height m	40	20

Average background concentration of PM₁₀ in the airshed of 10 km is around 40 ug/m³. We provide you below a step by step guidance

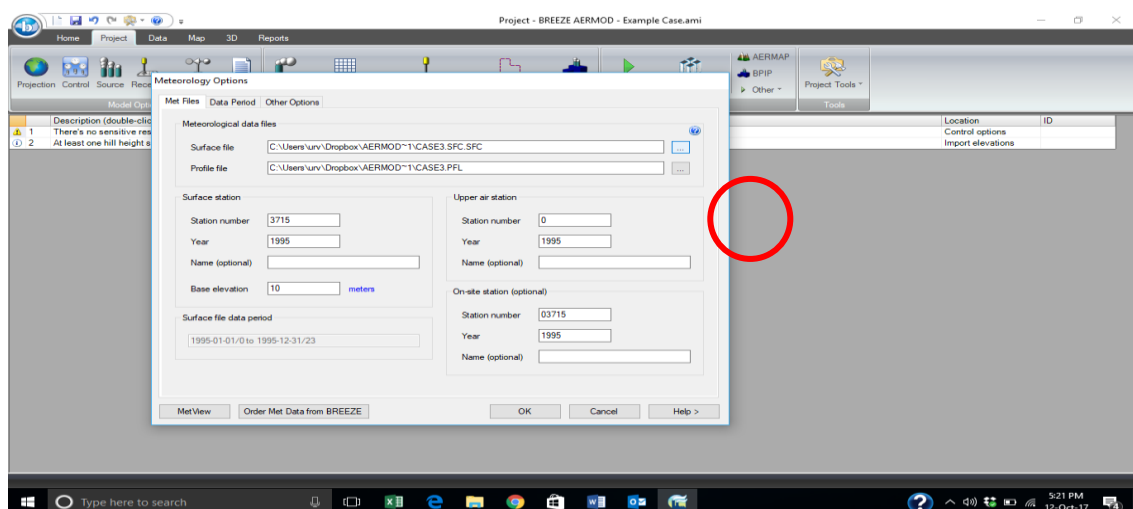
- 1) Open Breeze AERMOD and click on PROJECTION Button on the “Model Options” taskbar as shown in the screenshot below:



- 2) Enter the UTM Zone of the location in the problem. In our case, Nagpur falls in the UTM zone 43. Click on the grid to select the zone as shown in the screenshot below:



- 3) Next, load the Meteorological files provided with the assignment. Enter the year as 1995 as the meteorological file is for the year 1995. Enter data period as Jan1 to Jan31, 1995 in the Data Period tab. Your screen should appear as shown below:



Meteorology Options

Met Files Data Period Other Options

Data period

☐ All hours ☒ Start/end ☐ Day range

Start/end

Start date: January 01, 1995

Start hour: 1

End date: January 31, 1995

End hour: 24

MetView Order Met Data from BREEZE OK Cancel Help >

- 4) Click on the SOURCE button in the “Model Objects” taskbar.
- 5) You will be prompted to a Source Definition dialog box as shown below. Enter the stack details for both the stacks provided in the problem statement as shown in the screenshot below:

Project - BREEZE AERMOD - Example Case.ami

Home Project Data Map 3D Reports

Projection Control Source Recd

Model Objects

Source - STACK

Source Parameters Building Downwash

Description/location

ID: STACK

Description: Short Stack

X coordinate: 290194.75 meters

Y coordinate: 2341243.18 meters

Elevation: 0 meters

Source options

☒ Account for building downwash

☐ Use variable emission rates

☐ Define deposition parameters

☐ Particle

☐ Gaseous

Parameters

Source type: Point

Emission rate: 7.25 g/s

Stack height: 20 meters

Diameter: 0.75 meters

Temperature: 303 K

☒ Exit velocity: 0.85 m/s

☐ Flow rate

OK Cancel Help >

Project - BREEZE AERMOD - Example Case.ami

Home Project Data Map 3D Reports

Projection Control Source Recd

Model Objects

Source - STACK2

Source Parameters Building Downwash

Description/location

ID: STACK2

Description: Tall Stack

X coordinate: 290406.56 meters

Y coordinate: 2341161.42 meters

Elevation: 0 meters

Source options

☒ Account for building downwash

☐ Use variable emission rates

☐ Define deposition parameters

☐ Particle

☐ Gaseous

Parameters

Source type: Point

Emission rate: 11.5 g/s

Stack height: 40 meters

Diameter: 0.85 meters

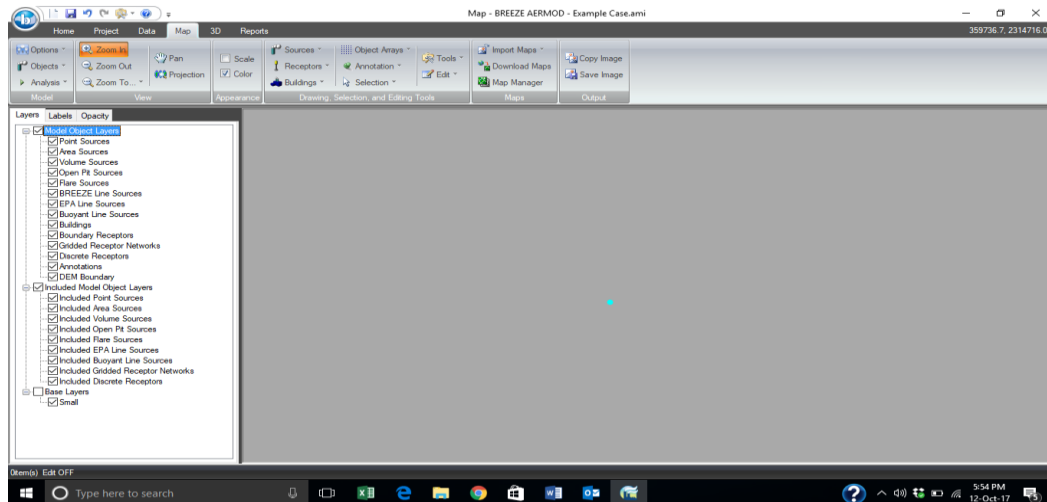
Temperature: 305.37 K

☒ Exit velocity: 1.8 m/s

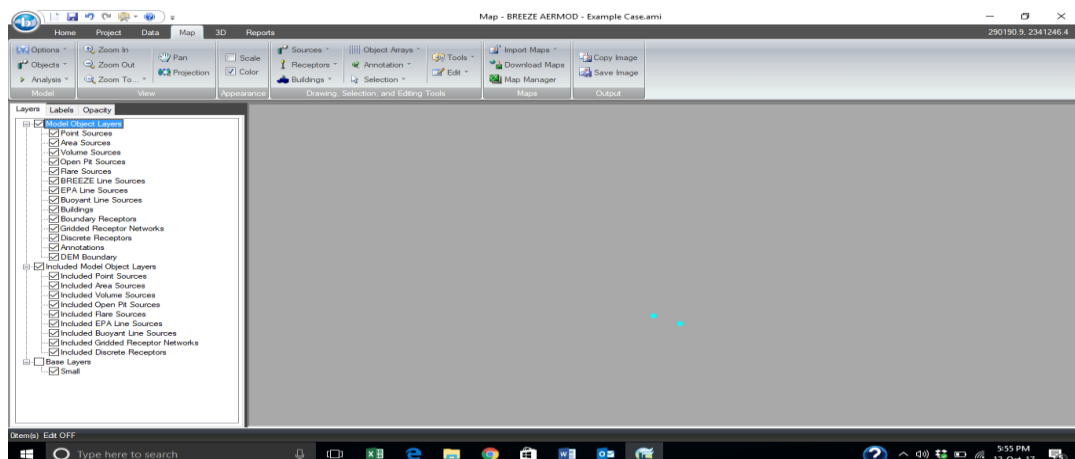
☐ Flow rate

OK Cancel Help >

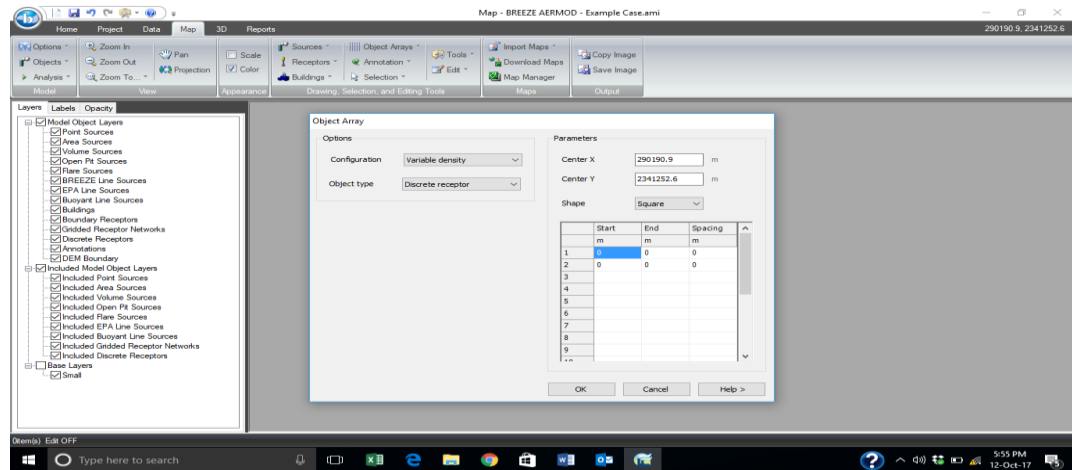
- 6) Now, once the sources are defined, you will need to define receptor grid. Click on the MAP button on menu bar as shown in screenshot



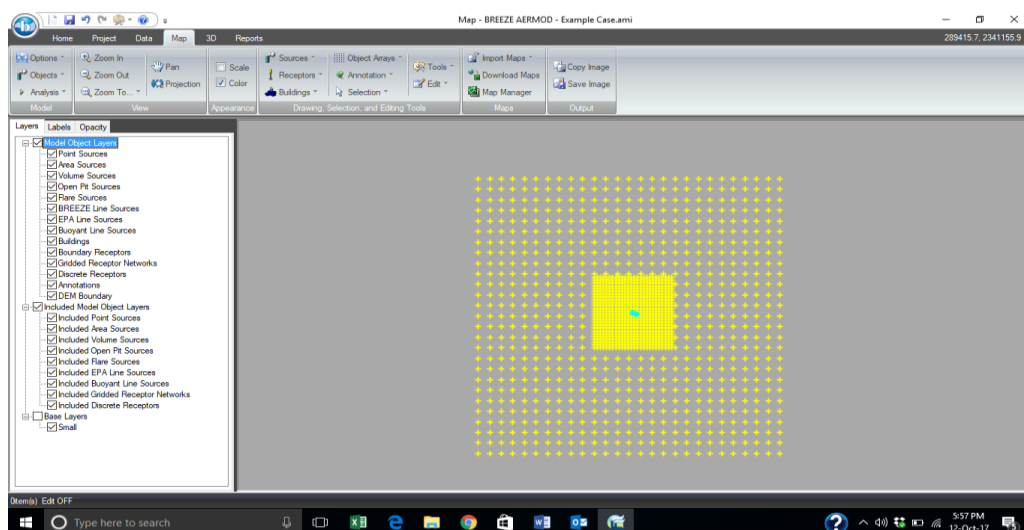
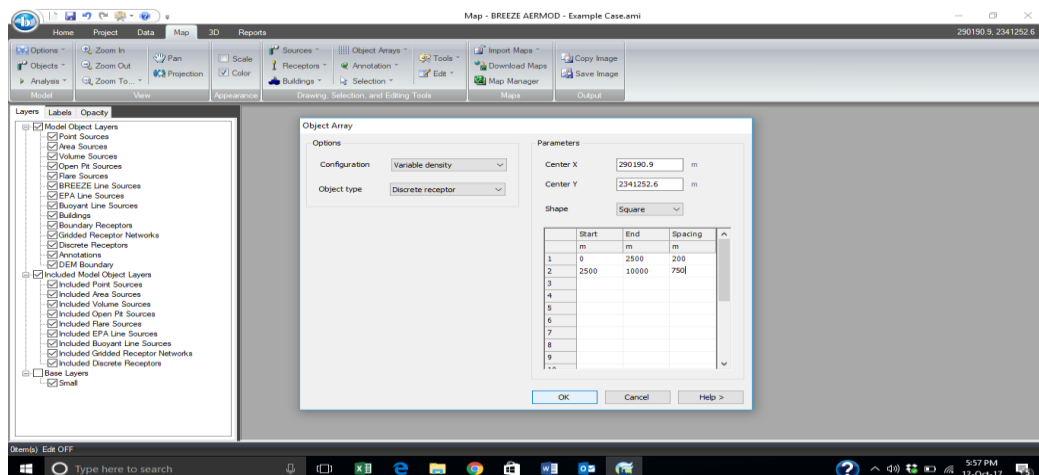
- 7) Click on the VARIABLE DENSITY option in the OBJECT ARRAY button on the DRAWING, SELECTION & EDITING TOOLBAR. Refer the Screenshot below



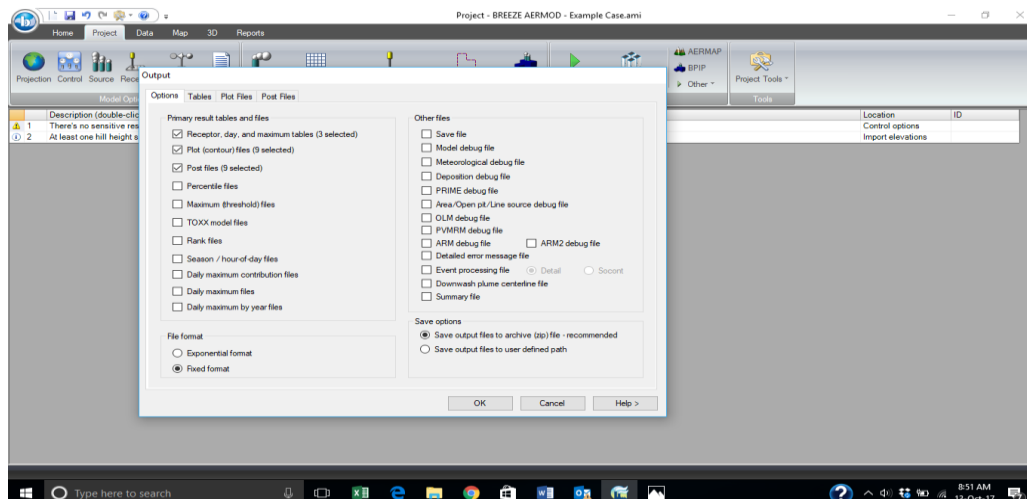
- 8) Your cursor will change to a "+" pointer. Click on the stack-1 with the pointer to place the center of the grid.
- 9) You will be prompted to a Variable grid definition dialogue box as shown below:



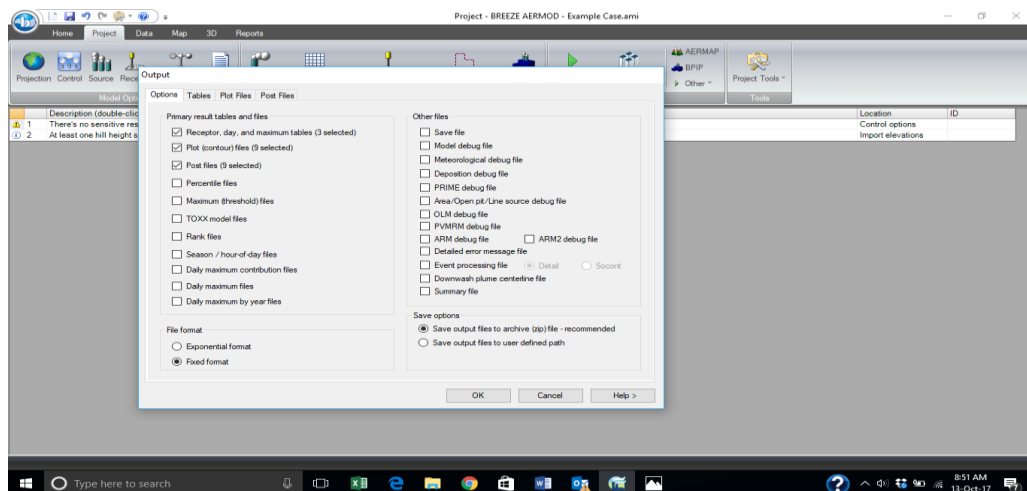
10) Enter the desired Grid spacing. In this example, please enter a 200 m spacing for 2500 m & 750 m spacing for distance from 2500 to 10000 m, on all four sides of the stack-1. Please refer the screen shot below:



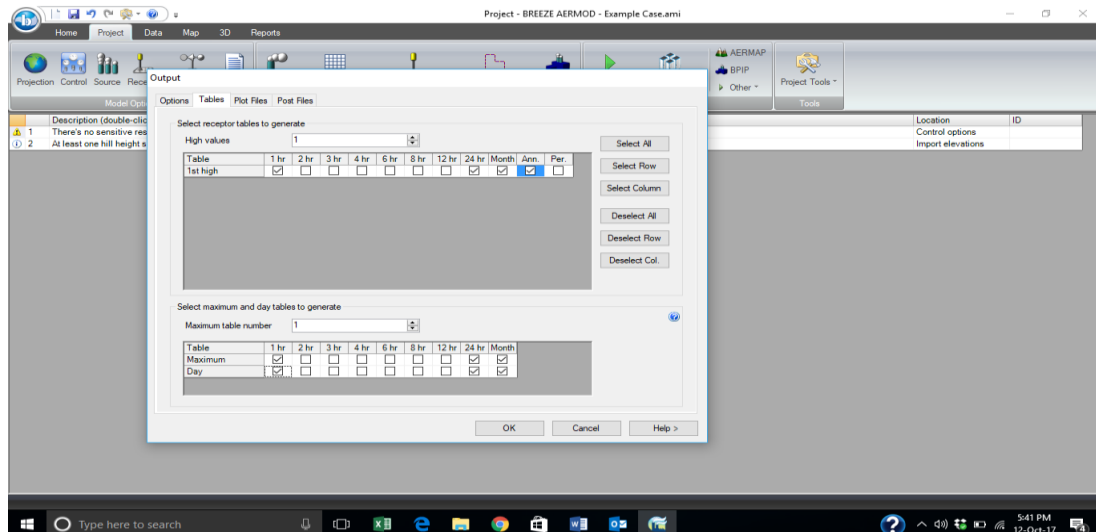
11) Click on the OUTPUT button on the MODEL OPTIONS taskbar. You will be prompted with a dialog box as shown in the screen shot below



- 12) In the OPTIONS tab select 3 options from the Primary results, tables and files list i.e. a) Receptor, day & maximum tables b) Plot (contour) files c) Post files ; also select “Fixed format” in the File Format selection ; Select “Save output files to archive (zip) file” option in the Save options. Your screen should appear as shown in the screenshot below:

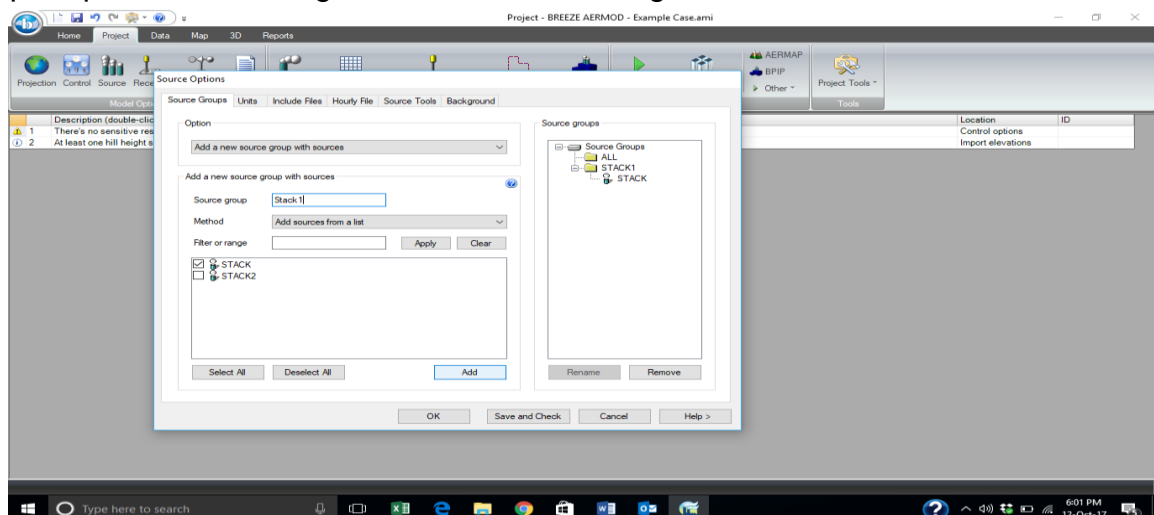


- 13) Now in the same dialog box select the TABLES tab. Select “1hr”, “24hr”, “Month” options in the “Select receptor tables to generate”. Also select the same options for “Select Maximum and day tables to generate”. Your screen should appear like the screen shot shown below

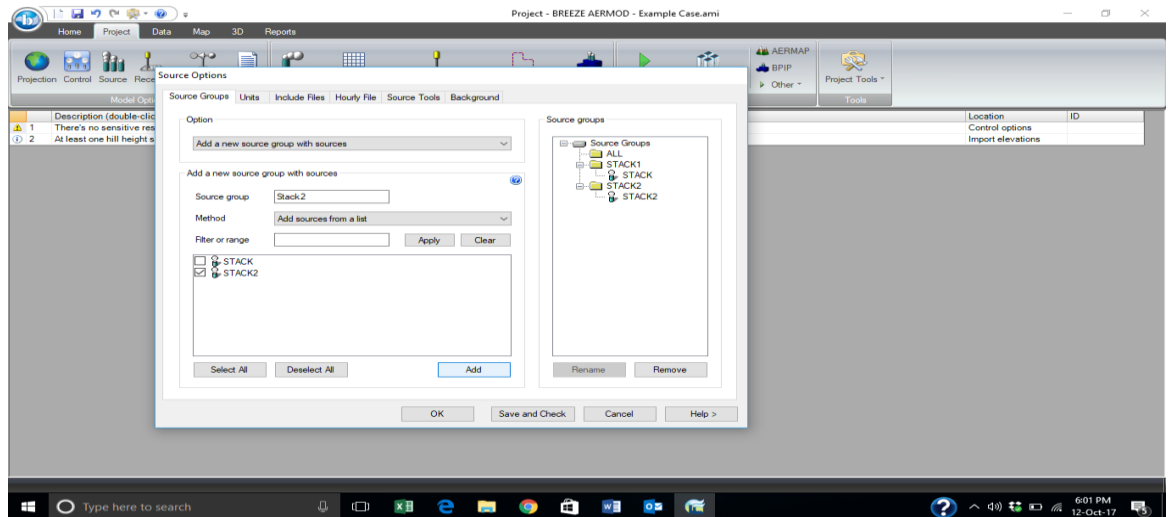


14) Repeat the previous step for PLOT files as well as POST files tab.

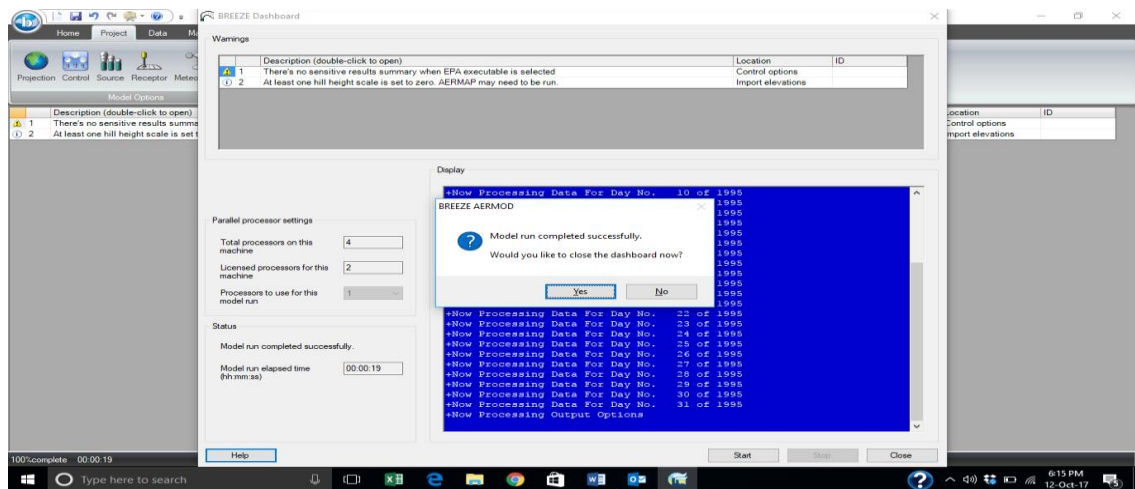
15) Now, Click on the SOURCE button on the Model options taskbar. You will be prompted with a dialog box as shown in the figure below:



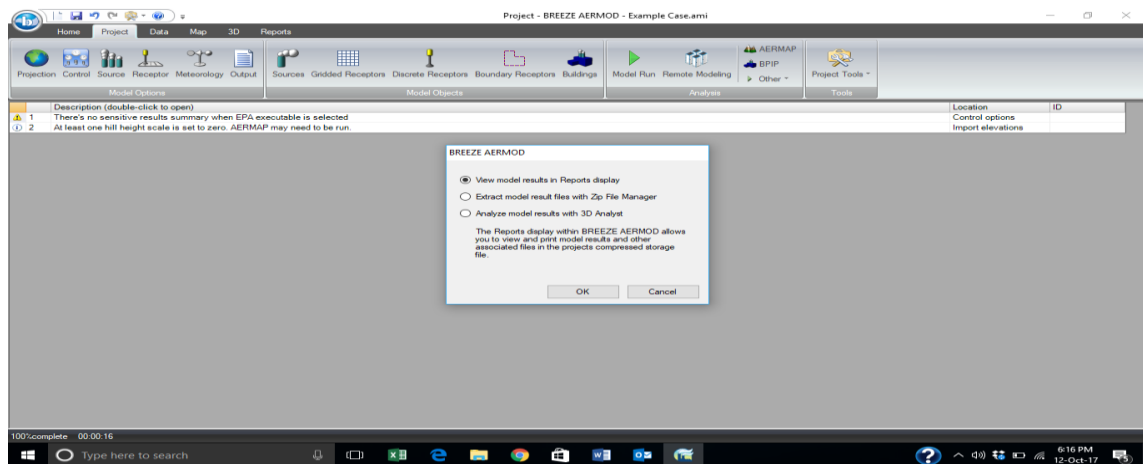
16) For finding the relative source contribution, you will need to make the model run as 3 parallel runs with considering a) Both stacks b) Only Stack 1 c) Only Stack 2. For this, Select "Stack"(Stack1) from the "Add a new source group with sources" and Write the name of source group as "Stack1". Repeat the same process for the Stack-2. You Dialog box should appear as shown in figure below:



- 17) Now, your model is all set to run. Click the MODEL RUN button on the ANALYSIS taskbar.
- 18) You will be prompted with a window as shown in screenshot below. Click on Start to start running the model.
- 19) After your model run is complete, click on the Close the dialog box option as shown below



- 20) You will be prompted to following dialog box
- 21) Select Analyze mode results with 3D analyst and click on OK



22) The program will automatically open the 3D analyst application and create a contour

Based on the above step wise instructions, generate graphical and tabular outputs and **prepare a report** and make recommendations for the stack heights, emission rate and stack spacing

The assignment should be completed latest by November 15, 2017 and the report should be sent to **Joint Director (Air), MPCB**

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Annex 6 – AQ data for India

- National Data: [CAAQM](#): CAAQM Station- Continuous Ambient Air Quality Monitoring Station. Currently ~50 cities with real-time data
- Delhi Data: Delhi Government: [Delhi Pollution Control Committee](#). Other: Delhi [AQ forecasts](#)
- [SAFAR](#) (MoES- Delhi, Mumbai, Pune, Ahmedabad): Daily forecasts and PM concentrations are available, but historical data cannot be downloaded.
- [US Consulates](#) (US Government- Delhi, Mumbai, Chennai, Hyderabad, Kolkata) Data available for PM2.5
- Sensor networks
 - IndiaSpend #breathe: India's first independent air quality monitoring [network](#) built on low-cost PM devices
 - Hindustan Times Air Quality [network](#)

Other sources to access air quality data

- [OpenAQ](#): Access air quality data from around the world
- [AQICN](#): Real-time air quality index (AQI) data from around the world
- [WAQI](#): World Air Quality Index data from around the world