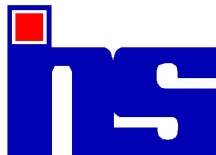


Air Quality Monitoring Stations in Hyderabad - Field Notes

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Air Quality Monitoring Stations in Hyderabad - Field Notes

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I. Introduction:

Air quality is monitored by Andhra Pradesh Pollution Control Board (APPCB) at certain sites in Hyderabad city. These Air Quality Monitoring Stations (AQMS) have been set up under the National Ambient Air Quality Monitoring Programme (NAAMP) started by the Central Pollution Control Board (CPCB) in 1984. The air pollution parameters monitored through these AQMS centres include - Sulphur dioxide (SO_2), Nitrogen oxides (NO_x), Carbon monoxide (CO) and Total Suspended Particulate Matter, that includes both Non- respirable Suspended Particulate Matter (NRSPM) & Respirable Suspended Particulate Matter (RSPM).

There are currently a total of twenty one (21) AQMS centres (Annexure-1) in Hyderabad, which have been in operation since September 2001 onwards. Only in three stations viz., Balanagar, Uppal & Jubilee Hills, monitoring is done round-the-clock, in three shifts. For the remaining eighteen (18) stations, 8 hourly averages are recorded. These yield only daily averages based on monitoring done from 8 AM to 4 PM (one shift only). Of these 18 stations, 8 hourly averages are monitored on a biweekly basis in twelve (12) stations and on a daily basis in the remaining six (6) stations.

The purpose of this study is to understand the operation, maintenance and data collection process at the AQMS centres. The three round-the-clock AQMS sites were visited. The operator in charge of each station was interviewed. Another person (observer) from the respective sites was also interviewed.

First the equipment is described. This is followed by a record of discussions with the operators and observers.

II. Equipment being used:

A. APM 460 / 451 Respirable Dust Sampler (RDS) :

The APM 460/ 451 sampler has been designed by Envirotech Instruments (P) Ltd., New Delhi based on know how developed at National Environmental Engineering Research Institute (NEERI), the CSIR laboratory based at Nagpur. It first separates the coarser particles (larger than 10 microns) from the air stream before filtering it on the 0.5 micron pore-size filter allowing a measurement of both the Total Suspended Particulates (TSP) and the respirable fraction of the suspended particulate matter (RSPM).

Specifications of APM 460 / 451:

Flow Rate	0.9 -1.2 m ³ /min
Particle Size:	10 Microns to 0.5 Micron collected on filter paper. Filter holder designed to accept any standard filter sheet of 8"x10" size. SPM bigger than 10 Microns collected in a separate sampling bottle.
Recommended Filter:	Whatman GF/A Filter Paper .
Sampling Time:	28 Hours (Maximum)
Automatic Sampling Control:	24 hours programmable timer to automatically shut -off the system after preset time intervals.
Power Requirements:	Nominal 220V, single phase 50HZ. A.C. Built in Voltage stabilizer with Automatic shut-off beyond 170-270 V.
Overall Size:	Approximately 400 x 300 x 650 mm.

Principle of Operation:

Ambient air laden with suspended particulates enters the system through a inlet pipe. As the air passes through the cyclone, coarse, non-respirable dust is separated from the air stream by centrifugal forces acting on the solid particles. These separated particulates fall through the cyclone's conical hopper and collect in the sampling bottle placed at its bottom. The fine dust forming the respirable fraction of the Total Suspended particulates (TSP) passes through the cyclone and is carried by the air stream to the filter paper clamped between the top cover and filter adapter assembly. The Respirable dust (RSP) is retained by the filter and the carrier air

exhausted from the system through the blower. The respirable dust concentration is determined by a gravimetric analysis requiring an accurate estimation of the change in weight of the filter on account of the dust deposited on it. As such handling of the filter paper must be minimized and care should be taken that the paper does not get shredded or damaged during handling. The gravimetric analysis involves weighing of the filter to determine the quantity of respirable dust deposited on it and a weighing of the dust retained by the cyclone to assess the TSP concentration. To avoid the effect of moisture absorption on the filter, it must be suitably conditioned in a desiccator at room temperature for 12 to 16 hours prior to weighing.

Gaseous Sampling Attachment:

The APM 460 / 451 RDS has a gaseous sampling attachment for measuring SO_2 and NO_x . The suction side of the blower of RDS provides a suction for sampling air through a set of impingers. The two impingers are housed in a separate enclosure and kept in an ice tray. The separate enclosures and ice tray insulate the impingers from ambient temperature and heat generated in the motor of the blower. APM 411 has been provided with a Gas Manifold and Rotameter to allow setting up of independent sampling rates through each of the impingers. Gaseous pollutants (SO_2 , NO_x) are absorbed in suitable absorbing solutions placed in the impinger bottles. The absorbing reagents are recovered from the impingers and analyzed in the laboratory. The APM 411 gaseous sampling attachment can be easily detached from the main sampler and transported and stored independently.

Working Principle:

Ambient air is drawn at a constant rate with the help of an air sampler, where the suspended particulate matter (SPM) is inertially separated with the help of a cyclone into one or more size fractions within the 10 μm particulate matter (PM_{10}) size range. This is collected on a filter paper and particles of size greater than 10 μm diameter are collected in a dust box.

The exposed filter is equilibrated in the conditioning environment for at least 24hrs. under the same temperature and humidity conditions used for

pre-sampling filter equilibration and the post sampling weight is recorded. The difference in weight is divided by the volume of air sampled and is expressed in mg/m³ of respirable suspended particulate matter (RSPM).

The dust box is also weighed both before and after sampling. The difference in weight is divided by the volume of air sampled and is expressed in mg/m³ of non-respirable suspended particulate matter (NRSPM). Total SPM (TSPM) is arrived at by adding both RSPM and NRSPM.

Filter Paper Conditioning:

Temperature range : 15 – 30°C

Temperature control : + 3 °C

Humidity range: 20% to 45% RH.

Humidity control: + 5% RH

Dust box inert to reactive organics (preferably plastic) is used to collect the NRSPM

Analytical balance: with a sensitivity of at least 0.1mg is required.

Reagents: Not required.

Calculations:

General requirements:

$$Q_{std} = Q_a \times \frac{(P_{av})}{(P_{std})} \times \frac{(T_{std})}{(T_{av})}$$

Where,

Q_{std} = Average flow rate at standard reference conditions in m³/min.

Q_a = Average flow rate at ambient conditions in m³/min.

P_{av} = Average barometric pressure during sampling period (mm Hg)

T_{av} = Average ambient temperature during sampling period

T_{std} = Standard temperature, defined as 298K.

P_{std} = Standard pressure, defined as 760mm Hg.

Total volume of air sampled = V_{std}

$V_{std} = Q_{std} \times t$, where t = Sampling time.

PM₁₀ concentration in mg/m³
(Wt – Wi) x 10⁶

$$PM_{10} = \frac{\text{-----}}{V_{std}}$$

Where

PM₁₀ = Particulate matter mass concentration in mg/ std m³
Wi = Initial weight of filter collecting PM₁₀ particles g;
Wt = Final weight of filter collecting PM₁₀ particles g;
10⁶ = Factor to convert grams (g) to mg (Micro grams).

NRSPM concentration in mg/m³
(Wt – Wi) x 10⁶

$$NRSPM = \frac{\text{-----}}{V_{std}}$$

Where

NRSPM = Particulate matter mass concentration in mg/ std m³
Wi = Initial weight of filter collecting NRSPM particles g;
Wt = Final weight of filter collecting NRSPM particles g;
10⁶ = Factor to convert grams (g) to mg (Micro grams).

TSPM concentration in mg/m³ = RSPM + NRSPM

B. APM 460 DX

This sampler is an improved version of APM 460 / 451. It has a brushless blower, and the flow rate can be regulated at 1.0 m³ / min. The timer facility is also better in this model.

III. Visit to Selected Air Quality Monitoring Stations

A. Balanagar Station:

Date of visit: Monday, April 28 th, 2003.

Location of AQMS Centre: Central Institute of Tool Design, Balanagar.

Name of the Field Assistant: P. Rajeshwar Reddy.

Time of arrival: 11.45 AM.

Specifications of Equipment at Balanagar Station:

Envirotech RDS-APM 460-Sr no. 585, DTS 99.

Left from IHS at 11:00 AM. First went to APPCB Office and requested JSO, Mr. Raveendhar to depute a person to visit 24 hrs AQMS centres. Mr. Harding, Field Assistant was assigned to me. We reached CITD campus at

11.45 AM. The sampler is placed on top of CITD building. The field recorder, Mr. P. Rajeshwar Reddy was not present at the AQMS site at that time. He came at 12.00 noon. I interviewed him at 12:15 PM to review the recording procedure. He is a native of Chegunta village in Thimmajipet Mandal of Mahabub Nagar District. He received training in recording Ambient Air Quality parameters at APPCB in 1997. He is an intermediate dropout. He is pursuing B.Com from Ambedkar Open University. I inquired about the timing of shifts in the 24 hr monitoring activity. He informed that it is carried out in 3 shifts i.e., I shift - 6:00 AM to 2:00 PM; II shift - 2:00 PM to 10 PM & III shift - 10 PM to 6 AM. He has to be physically present only for the first 2 shifts from 6:00 AM to 10:00 PM. Since he has to come from Dilshuknagar, he has taken permission to report at Balanagar site at 7:30 AM. The field assistants are rotated among the 21 AQMS centres every month. He mentioned that the carbon brush of the blower at Balanagar station was replaced the previous day, as it had worn out. He told that samplers at some stations are brush free models. I asked him to give a step-wise account of the 24 hour monitoring activity.

1. Instal the filter paper between the filter cover and gasket assembly.
2. Instal the dust box below the cyclone and ensures that it is airtight.
3. Fills impingers housed in gaseous sampling attachment with 25 ml of SO₂ and NO_x absorbing reagents.
4. Before switching on the sampler, he sets the liquid column of Manometer with Distilled Water to Zero.
5. He takes care to see that filter paper is installed before starting the sampler, other wise the liquid column of manometer will fell below '0' level, which is not desirable.
6. He then sets the timer to start, notes the initial time totaliser reading, records the flow rate indicator of the Manometer, which should be 1.1 m³/min, and then switches on the sampler.
7. After this, every hour, he has to note the time totaliser reading, record the flow rate of manometer and ensure that it does not fall below 1.0 m³/min, as there will be pressure drop due to deposition of SPM. I watched him while he was taking the hourly readings at 12:00 Hrs. and 1:00 PM.
8. He has to replace the gaseous reagents once every 4 hrs.
9. He has to replace the filter paper once every 8 hrs.
10. After the sample time is over, he switches off the sampler, and notes the final time totaliser reading.
11. After this, he removes the filter paper carefully and stores it in a clean envelope.

12. He then removes the dust box.
13. At 10.00 PM, the end time of second shift, he removes the filter paper & dust box installed at 2.00 PM, and absorbing reagents of SO₂, NO_x.
14. He then installs the fresh filter paper & dust box for the 3rd shift and records the sampling / flow rate of Manometer at start of sampling and notes the initial time totaliser reading.
15. He comes the next day (Tuesday) morning, and notes the final time totaliser reading.
16. He deposits the filter paper, dust boxes & absorbing reagents of gaseous pollutants at PCB office & takes the day off on Tuesday.

He then works on Wednesday from 8 AM to 4 PM for recording 8 hourly averages. Thursday is his weekly off. Friday is again 24-hr monitoring day. On Saturday 8 - hourly averages are recorded based on monitoring done from 8 AM to 4 PM. 24 -hr monitoring is done on a biweekly basis on Mondays and Fridays and 8-hour averages are recorded on Wednesdays and Saturdays. Sunday is also weekly off. The total work time per week for recorders is 48 hours, which works out to 8 hours per day.

The field assistants are paid a consolidated sum of Rs. 2000/- PM + Bus Pass allowance. A log book is to be filled by Field Assistants maintained by PCB, to check the activities of recorders.

I then interviewed Mr. T. Jayapal, Care Taker, CITD about the monitoring equipment placed on top of CITD building.

1. He is aware of AQM Equipment installed at CITD.
2. He stated that it is operated by APPCB and meant for checking Industrial Pollution levels.
3. He mentioned that recorders visit the site regularly.
4. CITD is providing space for installing equipment and power supply. APPCB pays the electrical bills charged on an unit consumption basis.
5. He has seen the equipment in operation once and is aware that it runs continuously for 24 hrs, twice a week.
6. The RDS has been placed at CITD for more than 9 years now.
7. Though CITD is not directly benefited from the activity, the Principal Director of CITD has given permission for installing the AQM equipment, as it generates data on ambient air pollution and is a useful index of air quality status in Balanagar area.
8. He stated that earlier there was lot of industrial pollution from IDPL unit, but this has reduced after closure of this unit.

We left for Jubilee Hills station at 1:30 PM.

B. Jubilee Hills Station:

Date of visit: Monday, April 28th, 2003.

Location of AQMS Centre: Jubilee Hills Police Station.

Name of Field Assistant : G. Shyam Sunder.

Time of arrival: 1: 50 PM.

Specifications of Equipment at Jubilee Hills Station:

Envirotech RDS- APM 460 DX, Brush less Blower, Sr. No. 215, DTV 00.

We reached Jubilee Hills Police Station at 1:50 PM. The field recorder, Mr. G. Shyam Sunder was present at the site during our visit time. The sampler is located on top of the police station. He was about to start the second shift (2:00 PM to 10:00 PM) in the 24- hour monitoring activity.

I noted the steps as he was preparing for the second shift.

1. He first cleaned the sampler & filter paper set.
2. He then installed the fresh filter paper and dust box.
3. He put 25 ml of absorbing reagents of SO₂ & NO_x in the impingers.
4. He set the Manometer liquid column to Zero with distilled water .
5. He put water in the ice tray of gaseous sampling attachment. Ideally ice should be used, but APPCB is not providing ice.
6. He then noted the initial time totaliser reading, set the timer to start, recorded the flow rate indicator (1.0 m³ /min) of Manometer and switched the sampler on.

While waiting for completion of 1 hour period after the start of second shift, I interviewed him to understand the recording procedure followed by him. He is basically from Hyderabad, a commerce graduate, who got trained in recording ambient air quality parameters at APPCB in 1998. He informed that he uses cycle as means of transportation for all stations within MCH area. He is currently pursuing M.Com Correspondence course from Osmania University. He takes all necessary precautions and follows the prescribed guidelines religiously during 24-hour monitoring activity. He stated that as no kit / bag has been provided for transporting absorbing reagents for gaseous pollutant sampling, sometimes reagents get spilled during transportation. As PCB does not issue any ID cards not even temporary cards, they find it difficult to work during odd hours especially during the nights. They are plagued by problems of insecurity, as field staff are always under threat of termination of

their services. He stated that as the field assistants have not been imparted training to handle minor technical problems during sampling, they have to contact PCB Office during trouble shooting and wait till the PCB technician rectifies the problem.

At 3.00 PM, as part of hourly readings, he noted the time totaliser reading, and checked the flow rate of Manometer, which was $1.0 \text{ m}^3 / \text{min}$, and recorded the same in the data sheet.

After this, I interviewed Mr. J.J Chandra Reddy, Head Constable, Jubilee Hills Police Station to ascertain his awareness about air quality measurement activity. He mentioned that the APPCB has installed an equipment on top of Jubilee police station for pollution testing. It has been in place for 1 and $\frac{1}{2}$ years now. He has only seen the equipment externally, but never seen it in operation, as they are quite busy with their routine activity. Both the space and power supply is provided by police station free of cost. He mentioned that the field assistant reports at the monitoring site regularly. He stated that as Jubilee Hills is predominantly a residential area with lots of greenery, the pollution levels are negligible. He added that the field assistants are not in a position to give information on pollution concentration levels for Jubilee Hills Police Station.

C. Uppal Industrial Development Area Station:

Date of Visit: Friday, 2nd May, 2003.

Location of AQMS : Modern Foods Factory

Name of Field Assistant: Marram Reddy John

Time of arrival : 3: 45 PM

Specifications of Equipment at Uppal Station:

Envirotech RDS- APM 460, Sr. no. 227, DTJ 97.

Left from IHS at 2:00 PM for APPCB office, picked up Mr. Harding, Field Assistant and proceeded to Uppal for reviewing 24-hour monitoring activity at that station. Reached Modern Foods Factory at 3:45 PM. The Field Assistant, Mr. Marram Reddy John was present at the site. We went along with him on the top of factory roof, where the sampler is installed. I watched him while he

was taking hourly readings at 4:00 PM. He noted the time totaliser reading and flow rate of manometer ($1.0 \text{ m}^3 / \text{min}$) and entered the same in the data sheet.

After this, I interviewed him about his role as field recorder. He resides in Uppal. When he is allotted to Uppal station, he reaches the site before 6:00 AM. But if he is assigned to far off stations such as Balanagar, he takes 1 hour late permission from PCB owing to commutation problems. He joined as daily wages field assistant in 1997 after completion of intermediate. He is now pursuing B.Sc. (BZC) from Ambedkar Open University. He mentioned that there was some problem with the AQMS equipment at Uppal. The brushes of blower which clean carbon, were being worn out and needed to be replaced every day. Carbon brushes usually last for 100 hrs. He brought this to the notice of PCB technician and this problem has since been rectified. He mentioned that if the brushes are not replaced on being worn out, the sampler will not function properly. There is an indication when carbon brushes get worn out in the form of light blinking near start button. He also expressed that reagents get spilled during transportation. He stated that lack of ice is resulting in evaporation of absorbing reagents of SO_2 & NO_x in hot summer months. He pointed out that if field recorders go out briefly, and if in their absence, there is power breakdown, they should note the time totaliser reading. However, in Uppal station, this question does not arise, as there is a generator back-up facility at the factory. He expressed that even though he has been working as field recorder for 6 years now, there is no job security. He feels that the field assistants are losing out on age and will not be in a position to search for alternate jobs.

I then interviewed Mr. Yadagiri, Sales Counter personnel at Modern Foods factory. He is aware of equipment being installed at Modern Food Factory since 7 years. He knows that it is a pollution testing equipment operated by APPCB. He stated that field recorders are sincere and regular in their duties. Sometimes they sit in the sales counter and visit the monitoring site every hour to take readings. He has not seen the equipment in operation so far, as he feels that it is not directly related to him and also since time does not permit.

Annexure -1: Air Quality Monitoring Station (AQMS) Location and Current Recording Pattern

S.No. AQMS Location	Current Recording Pattern
1 Balanagar (Central Institute of Tool Design Building)	24-hour Monitoring
2 Uppal (Modern Foods Factory)	24-hour Monitoring
3 Jubilee Hills (Police Station)	24-hour Monitoring
4 Chikadpally (Police Station)	8-hour Biweekly Monitoring
5 Jeedimetla (Fire Station)	8-hour Biweekly Monitoring
6 Langar Hauz (Police Station)	8-hour Biweekly Monitoring
7 Mehdiapatnam (Police Station)	8-hour Biweekly Monitoring
8 Shameerpet (MRO Office)	8-hour Biweekly Monitoring
9 Kukatpally (Police Station)	8-hour Biweekly Monitoring
10 Sainikpuri (A.P. Residential School)	8-hour Biweekly Monitoring
11 Rajendranagar (Agricultural University)	8-hour Biweekly Monitoring
12 Gachibowli (Central University)	8-hour Biweekly Monitoring
13 Begumpet (IAS Officer's Association Building)	8-hour Biweekly Monitoring
14 Nacharam (Police Station)	8-hour Biweekly Monitoring
15 Imlibun (APSRTC Bus Depot)	8-hour Biweekly Monitoring
16 Abids (Police Station)	8-hour Daily Monitoring
17 Punjagutta (Police Station)	8-hour Daily Monitoring
18 Paradise (Water Works Office)	8-hour Daily Monitoring
19 Charminar (APSRTC Bus Stand)	8-hour Daily Monitoring
20 Bahadurpura (Zoo Park Curator's Office)	8-hour Daily Monitoring
21 Jubilee Hills (KBR Park)	8-hour Daily Monitoring