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Air Quality Index Puducherry
Air Quality Index for 2 cities at 6 locations for the year 2015

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National Ambient Air Quality Monitoring Programme (NAMP)
(Manual monitoring system)

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Introduction

The Union Territory of Puducherry comprises of four regions namely Puducherry, Karaikal, Mahe and Yanam which lie scattered in South India. Puducherry, the capital of the Territory was once the original headquarters of the French colony in India. It was under the French rule for 138 years and merged with the Indian Union on 1st November 1954. It is bounded on the east by the Bay of Bengal and on the three sides by Tamil Nadu. About 160 kms south of Puducherry on the East Coast lies Karaikal. Mahe is situated on the Malabar coast on the Western Ghats surrounded by Kerala at about 653 km away from Puducherry. Yanam is situated adjoining the East Godavari district of Andhra Pradesh and is about 840 km Northeast of Puducherry.

The major contribution for air pollution in Puducherry is vehicular emission and industries etc.Pollutants are emitted into the atmosphere by natural and anthropogenic of which Particulate matters, Sulphur oxides and oxides of nitrogen are having the significant role on the impact on air quality. Therefore an attempt has been made to assess the overall air quality in the form of Air Quality Index (AQI).

Central Pollution Control Board (CPCB) has developed National Air Quality Index a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour. The index is named as IND-AQI (Indian Air Quality Index) and is useful as it indicate the day to day changes in Air Quality (http://www.cpcb.nic.in/FINAL-REPORT_AQI_.pdf). There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor and Severe. The AQI considers eight pollutants for which short-term (up to 24-hourly averaging period) standards are prescribed. However, AQI can be calculated if monitoring data is available for minimum three pollutants of which, one should necessarily be $PM_{2.5}$ or PM_{10}. Based on the measured ambient concentrations, corresponding standards and likely health impact, a sub-index is calculated for each of these pollutants. The worst sub-index reflects overall AQI.

Air Quality Monitoring Location and Methodology:

Puducherry Pollution Control Committee (PPCC) is presently carrying out ambient air quality monitoring at three locations each in Puducherry since, 1992. In Karaikal, since July 2014, 3 monitoring stations have been started. Sampling was carried out using Respirable Dust Samplers (RDS). The collected samples are analyzed for three parameters using standard

methods prescribed by CPCB. Particulate matter PM_{10} was estimated by gravimetric method. Known quantity of air is drawn through pre- weighed glass fibre filter paper, (GF/A) at a flow rate of 1 m^3/min on 8-hourly basis for 24 hours. Gaseous pollutants namely SO_2 and NO_2 are collected on four hourly basis for 24 hours by drawing air flow of 1L/min and are analyzed by Improved West and Gaeke for Sulphur di oxide and Jacob and Hochheiser modified method for Nitrogen di oxide respectively. Concentrations of the pollutants are measured in micrograms/cubic meter ($\mu g/m^3$).

In this report, the AQI was calculated using IND-AQI. The major air pollutant, which could cause potential harm to human health has been included are SO_2, NO_2, PM_{10}, $PM_{2.5}$, NH_3, CO, O_3 and Pb. It is also clearly mentioned that the concentrations of all eight pollutants are not necessary to calculate the index, although desirable. The index is so designed that AQI is reported for at least three parameters and one of them should be PM_{10} or $PM_{2.5}$, since manual stations measure PM_{10}, it is suggested that for manual station AQI for past days can be calculated as long as PM_{10} or $PM_{2.5}$ is measured. Table 1 shows IND-AQI Category and Range. Table 2 shows breakpoints for eight pollutant parameters considered for AQI with colour scheme to represent the AQI bands. Table 3 shows possible health impact for every AQI category to understand health effects and take necessary precautionary measures.

Table 1: IND-AQI Category and Range.

AQI Category	AQI Range
Good	0-50
Satisfactory	51-100
Moderately-Polluted	101-200
Poor	201-300
Very Poor	301-400
Severe	401-500

Table 2: Breakpoints for AQI Scale 0-500 (units: µg/m^3 unless mentioned otherwise)

AQI Category	PM_{10} 24-hr	$PM_{2.5}$ 24-hr	NO_2 24-hr	O_3 8-hr	CO 8-hr (mg/m3)	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	8.1-1600	1201-1800	3.1-3.5
Severe > 401	430+	250+	400+	748+	34+	1600+	1800+	3.5

* One hourly monitoring (for mathematical calculation only)

Table 3: Health Statements for AQI Categories

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

Interpretation of Air quality using IND-AQI: an example

The mathematical equations for calculating sub-indices were developed by considering health criteria as shown Table 2

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

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

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

I_{HI} = A_{QI} value corresponding to B_{HI}

I_{LO} = A_{QI} value corresponding to B_{LO}; subtract one from I_{LO}, if I_{LO} is greater than 50 Finally;

A_{QI} = Max (Ip) (where; p= 1, 2,…, n; denotes n pollutants)

Air Quality Index for 2 cities at 6 locations for the year 2015 through Manual Monitoring system under National Air Quality Monitoring Programme

24 hourly average concentration of the air pollutants assessed under National Ambient Air Quality Monitoring station (Manual system) viz., PM_{10} – Particulate Matter (less than or equal to10 µm), Sulphur-di-Oxide (SO_2) and Nitrogen-di-Oxide (NO_2) were taken into consideration for AQI calculation.

Results/Report:

AQI for the 2 cities for the month from January 2015 – December 2015

Sl.No	Month	Puducherry			Karaikal		
		No.of observations	AQI Status		No.of observations	AQI Status	
			Good	Satisfactory		Good	Satisfactory
1.	January	25	24	1	25	18	7
2.	February	24	20	4	24	21	3
3.	March	24	24	0	26	21	5
4.	April	22	22	0	25	25	0
5.	May	13	13	0	24	22	2
6.	June	23	19	4	26	24	2
7.	July	21	16	5	22	21	1
8.	August	24	23	1	25	25	0
9.	September	25	23	2	26	26	0
10.	October	22	22	0	26	26	0
11.	November	9	9	0	22	18	4
12.	December	13	13	0	20	18	2

The monthly AQI can be seen at http://dste.puducherry.gov.in/AQI_Status-re_modified.pdf

Status of Category-wise numbers of AQI in two cities (Puducherry & Karaikal) in the UT of Puducherry for the year 2015.

AQI Category	AQI Range	Colour Code	Number of AQI Values in different category		Pollutant-wise number of AQI values in AQI category	Possible Health Impacts
			No of AQI Values	% of AQI Values	PM_{10}	
Good	0-50		493	91.98	493	Minimal Impact
Satisfactory	51-100		43	8.02	43	Minor Breathing discomfort to sensitive people
Total AQI Values			536	100	536	

Note: AQI calculated from 24 hourly data of a particular location.

Overall summary:

The calculated AQI values for 24 hourly average concentrations are categorized as good to Satisfactory for the year 2015 at all the six location. The Prominent parameter is PM_{10}. The AQI value calculated for the two cities for PM_{10} showed 91.98 % of AQI value i.e. 493 AQI values in the U.T of Puducherry out of total 536 AQI values revealed good air quality, 8.02 % of AQI value i.e. 43 AQI values showed satisfactory air quality. It's pertinent to point out that there are not a single day which recorded moderate or poor or very poor or severe category both in Puducherry and Karaikal region.

Conclusion:

The overall AQI can give clear view about ambient air and the report reveals that PM_{10} is mainly responsible to determine the air quality which can be easier for a common man to understand.The PM_{10} concentration in the Puducherry and Karaikal region is sourced predominantly from the anthropogenic activity,which may be due to the increase in vehicle movement , road dust etc.

Observation:

From the measured values, the concentration of all the three pollutants are within the prescribed standard limit. There is no variation in Trends observed in all the three location in Puducherry when compared to the year 2014. At the location i.e DSTE, Particulate Matter (PM_{10}) contribution may be due to both Point & Non-Point sources (which includes Modern Rice Mill, vehicular movement as there is traffic intersection near to the site and also due to other Anthropogenic activity). In LAD, it may be due to vehicular emissions and re-suspension of road dust and in PIPDIC industrial Estate it may be due to point and non point sources (Automobiles and industrial emissions).

Action Taken:

Due to strenuous action taken by the PPCC, *viz*., upgradation of scrubber in the Sulphur handling units, replacements of firewood with cleaner fuel like LDO/Briquettes etc., the pollutants levels are within the prescribed norms and considerably reduced in the recent years.

Several 17 category industries operating in Puducherry were directed to provide suitable Air Pollution Control Devices (APCD) and continuous emission monitoring system for monitoring and controlling the emission from the sources. Besides, low levels of pollution in coastal cities like Puducherry is due to its excellent ventilation effects due to sea and land breezes which reduces pollution levels.

Reference:

This report is prepared based on the National Air Quality Index of CPCB under Manual monitoring system for National Ambient Air Quality Monitoring Programme

http://www.cpcb.nic.in/FINAL-REPORT_AQI_.pdf

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