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Research Paper

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Ambient Air Quality Monitoring and Possible Health Effects Due to Air Pollution in Atchutaapuram ,Andhrapradesh, India

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ABSTRACT

The study is to focus on ambient quality of air in Atchutaapuram, Andhrapradesh, India and its health effect on people. The study is carried out in the year of January 2012. Atchutaapuram is a Special Economic Zones in Visakhapatnam district in the Indian state of Andhrapradesh. The model which was considered to be the concentration of chemicals in the air of the work environment and possible negative health effects to people. The microclimate is under control except during very hot climate in summer. The chemicals are under control in coir producing, automobile and food industries. The chemicals are often over the limit in brick, alloy casting, granite industries and in some of the premises of pharmaceutical industries. According to work results, PM10 concentration varies from 32-51 ug/m3 where PM2.5 concentration varies from 8-14.5 ug/m3 and these are the highly polluting particles in work environment.

Introduction:

Atchutaapuram is Special Economic Zones in Visakhapatnam district in the Indian state of Andhrapradesh (Figure a). It is located about 30 kilometers south east of Visakhaptanam, 13 kilometres north- east of Anakapally, Atchutaapuram is known for its manufacturing industries and its pleasant climate. The work mainly concerned for the public health issues. Here, we put our effort to control the air pollution, even though can't succeed 100%. We preferred since it is the hub for many industries & factories. Moreover, automobiles and municipal wastages are also the major cause of the air pollution at Atchutaapuram. This made us to take survey on finding the root cause and case study which identify the main reasons that cause pollution in the surroundings of Atchutaapuram ,

Survey on industries at Atchutaapuram:

Atchutaapuram is a Special Economic Zones in Visakhapatnam district in the Indian state of Andhrapradesh, Large/Medium/Small industries are offering comprehensive services for more than 100 industries Industries of various kinds such as electrical, electronic, automobile, chemical, iron and steel are flourishing because of the favorable conditions and infrastructure availability. Information technology has a great scup for investment because of the proximity of visakhapatnam. Several reputed industrialist have started their units in Achuthapuram and having industries are M/s. WS Industries Limited, Uniparts India Limited, Bokarna Engineered Stones Limited, Vasanth Chemical Pvt. Ltd. ,oyotso Rare Earth Orissa Pvt., Ltd Achuthapuram has been able to attract some of the most prestigious industrial houses in the country Atchutaapuram Industrial area consists of about more industries comprising of large, medium, small and tiny industries. The units located at Atchutaapuram manufacture sophisticated products ranging from Trucks Automobiles, Automobile parts, Motor Cycles, Diesel engines, Power shift Transmission, Castings, Forgings, Cigarettes, Watches, Jewellery, Abrasives, Machineries, Pharmaceuticals, Biotechnology, Textiles, Chemicals, Electronic, Electrical and General Engineering. The main objective of this work is to determine the health risks due to air pollution in Achuthapuram and to create awareness among the people of this Area.

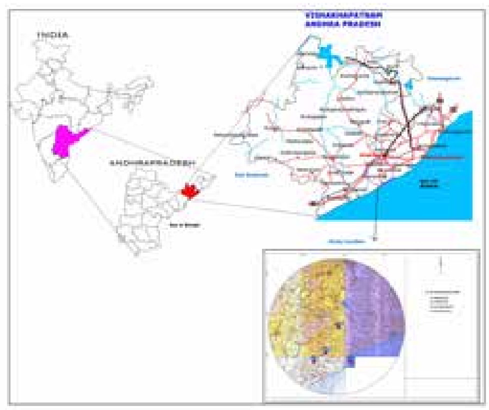

Figure a: Site map of Atchutaapuram

2.0 Materials and Methods:

Guidelines for Sampling and Measurement of notified Ambient Air Quality Parameters (NAAQS 2009):

Under the provisions of the Air (Prevention & Control of Pollution) Act, 1981, the CPCB has notified fourth version of National Ambient Air Quality Standards (NAAQS) in 2009 (Figure b). This revised national standard aims to provide uniform air quality for all, irrespective of land use pattern, across the country. There are 12 identified health based parameters, which are to measure at the national level and with a view to have data comparison, need for uniform guidelines for monitoring, sampling, analyses, sample flow chart, data sheet based on standard method has been felt.

The methods prescribed in the notification for respective parameters are the combination of

1. **Volume I:** Guidelines for manual sampling and analyses (along with sample flow chart and data sheets).

2. **Volume II:** Guidelines for continuous sampling and real time analyses.

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NATIONAL AMBIENT AIR QUALITY STANDARDS (2009)

Figure b: National Ambient Air Quality Standards

3.0 Results:

The statistical distribution parameters for PMlO and PM25 and trace metals (Pb, As and Ni) in Tables (1, 2 and 3). The PMlO concentration varies from 32-51 ug/rn" where PM25 concentration varies from 8-14.5 ug/rn", The concentrations of all pollutant are well within the permissible limits of National Ambient Air Quality standards stipulated as per the CPCB notification, 18th November, 2009.

Pollution Control Board (CPCB) of India. Apart from industries, the diesel vehicle exhaust is also responsible for emitting particulate matter (PMlO) in large amounts. The test results for air quality monitoring in 4 different places in Atchutaapuram is given below (Table 1, 2 ,3and 4).

3.1 Test conditions:

Test was carried out on 24 hours of s" January 2012. Ambient Temperature during test was 22.7 DC (Minimum) and 29.0 DC (Maximum). Relative Humidity was 58.3% (Minimum) and 91.6% (Maximum). Wind Speed was at 2.21 m/sec and sky was observed to be clear and nil rainfall.

Detailed Ambient Air Quality Results

Table1: Location: Atchutapuram

Date of monitoring: 19.01.2012

S.No.	Parameters	Unit	1 st shift (6 AM to 2 PM)	2 nd shift (2 PM to 10 PM)	3 rd shift (10 PM to 6 AM)	24 hrs Avg.
1	PM 10	µg/m^3	46.5	51.2	42.1	46.6
2	PM 2.5	µg/m^3	13.5	14.5	10.8	12.9
3	SO_2	µg/m^3	9.5	10.2	8.2	9.3
4	NO_x	µg/m^3	13.5	16.5	10.8	13.6
5	Carbon monoxide as CO	mg/m^3	0.8	0.9	0.6	0.8
6	Ammonia as NH_3	µg/m^3	18.5	20.5	16.4	18.5
7	Ozone as O_3	µg/m^3	22.5	26.7	20.4	23.2
8	Lead as Pb	µg/m^3	0.013	0.015	0.01	0.013
9	Benzene as C_6H_6	µg/m^3	0.1	0.12	0.008	0.1
10	Benzo (a) Pyrene	ng/m^3	BDL	BDL	BDL	BDL
11	Arsenic as As	ng/m^3	BDL	BDL	BDL	BDL
12	Nickel as Ni,	ng/m^3	BDL	BDL	BDL	BDL

Table 2:Location : Pudimadaka

Date of monitoring: 20.01.2012

S.No.	Parameters	Unit	1 st shift (6 AM to 2 PM)	2 nd shift (2 PM to 10 PM)	3 rd shift (10 PM to 6 AM)	24 hrs Avg.
1	PM 10	µg/m^3	34	36.2	32.5	34.2
2	PM 2.5	µg/m^3	8.2	8.6	8.2	8.3
3	SO_2	µg/m^3	7.5	7.8	6.5	7.3
4	NO_x	µg/m^3	10.3	11.2	8.9	10.1
5	Carbon monoxide as CO	mg/m^3	0.7	0.8	0.5	0.7
6	Ammonia as NH_3	µg/m^3	8.5	9.5	7	8.3
7	Ozone as O_3	µg/m^3	20.5	22.6	20.4	21.2
8	Lead as Pb	µg/m^3	0.008	0.009	0.007	0.008
9	Benzene as C_6H_6	µg/m^3	0.09	0.1	0.07	0.1
10	Benzo (a) Pyrene	ng/m^3	BDL	BDL	BDL	BDL
11	Arsenic as As	ng/m^3	BDL	BDL	BDL	BDL
12	Nickel as Ni,	ng/m^3	BDL	BDL	BDL	BDL

Table 3:Location: Dibbapalem

Date of monitoring: 21.01.2011

S.No.	Parameters	Unit	1 st shift (6 AM to 2 PM)	2 nd shift (2 PM to 10 PM)	3 rd shift (10 PM to 6 AM)	24 hrs Avg.
1	PM 10	µg/m^3	40.1	43.2	36.2	39.8
2	PM 2.5	µg/m^3	8.8	9.4	8.0	8.7
3	SO_2	µg/m^3	9.8	10.5	9.5	9.9
4	NO_x	µg/m^3	13.5	14.8	12	13.4
5	Carbon monoxide as CO	mg/m^3	0.7	0.8	0.5	0.7
6	Ammonia as NH_3	µg/m^3	14.5	18.2	12.3	15.0
7	Ozone as O_3	µg/m^3	22.5	26.5	24.2	24.4
8	Lead as Pb	µg/m^3	0.009	0.012	0.008	0.09
9	Benzene as C_6H_6	µg/m^3	0.1	0.1	0.08	0.1
10	Benzo (a) Pyrene	ng/m^3	BDL	BDL	BDL	BDL
11	Arsenic as As	ng/m^3	BDL	BDL	BDL	BDL
12	Nickel as Ni,	ng/m^3	BDL	BDL	BDL	BDL

Table 4:Location: Vijayaramaplaem
Date of monitoring: 22.01.2012

S.No.	Parameters	Unit	1 st shift (6 AM to 2 PM)	2 nd shift (2 PM to 10 PM)	3 rd shift (10 PM to 6 AM)	24 hrs Avg.
1	PM 10	µg/m³	38.2	40.2	34.2	37.5
2	PM 2.5	µg/m³	8.5	10.2	8.4	9.0
3	SO_2	µg/m³	9.2	10.5	7.9	9.2
4	NO_x	µg/m³	12.5	14.8	9.5	12.3
5	Carbon monoxide as CO	mg/m³	0.7	0.7	0.5	0.6
6	Ammonia as NH_3	µg/m³	16.8	14.5	12.2	14.5
7	Ozone as O_3	µg/m³	23.5	28.5	23.4	25.1
8	Lead as Pb	µg/m³	0.09	0.012	0.008	0.01
9	Benzene as C_6H_6	µg/m³	0.06	0.07	0.04	0.1
10	Benzo (a) Pyrene	ng/m³	BDL	BDL	BDL	BDL
11	Arsenic as As	ng/m³	BDL	BDL	BDL	BDL
12	Nickel as Ni,	ng/m³	BDL	BDL	BDL	BDL

* BDL:Below Detection Limit

3.3 Test conditions:
Test was carried out on 24 hours of s" September 2011. Ambient Temperature during test was 22.7 °c (Minimum) and 29.0 °c (Maximum). Relative humidity was 58.3% (Minimum) and 91.6% (Maximum). Wind Speed was at 2.21 m/sec and sky was observed to be clear and nil rainfall.

3.4 Various Air Pollutants and their Health Effects
3.4.1 Carbon monoxide
The binding of carbon monoxide (CO) with haemoglobin to form carboxyhaemoglobin (COHb) reduces the capacity of blood to carry oxygen, and the binding with other haemoglobin proteins is directly related to changes in the functions of affected organs, such as the brain, cardiovascular system, exercising skeletal muscle and the developing fetus. At very high concentrations, well above normal ambient levels, CO causes death. A COHb level of 2.5% should not be exceeded to protect middle-aged and elderly people with documented or latent coronary artery disease from acute ischaemic heart attacks and to protect the fetuses of pregnant women from untoward hypoxic effects.

3.4.2 Ozone
Ozone (03) is a secondary photochemical pollutant formed from the precursor's volatile organic compounds, NOx and CO in the presence of short wavelength solar radiation. Acute exposure to high ozone levels can induce changes in lung function, airway inflammation and increased airway responsiveness to bronchoconstrictors. Ozone can enter the body through inhalation and can reach the respiratory system because it is not very soluble in water.

3.4.3 Sulfur dioxide
A range of chronic and acute health impacts may result from human exposure to sulfur dioxide (S02) or related species. Particulate aerosol formed by the gas-to-particle formation has been found to be associated with numerous health effects, as mentioned in the section on PMlO. In a gaseous form, S02 can irritate the respiratory system; in case of short-term high exposure, a reversible effect on lung functioning may occur, according to individual sensitivity. The secondary product H2S04 primarily influences respiratory functioning. Its compound, polynuclear ammonium salts or organo-sulfates, act

mechanically in alveoli and, as easily soluble chemicals, they pass across the mucous membranes of the respiratory tract into the organism (Hangartner et 01.,1989).

3.4.4 Nitrogen dioxide
Nitrogen dioxide (N02) is an air pollutant produced in combustion processes. Whenever nitrogen dioxide is present, nitric oxide (NO) is also found; the sum of NO and N02 is collectively referred to as nitrogen oxides (NO,). Only the health effects of NO, are considered here. At very high concentrations, which may only be encountered in serious industrial accidents, N02 exposure can result in rapid and severe lung damage. N02 primarily acts as an oxidizing agent that may damage cell membranes and proteins (Atkins et 0/., 1986). To protect the general public at large from such chronic effects, therefore, an annual average guideline value of 40 ~g/m3has been set (WHO, 1995).

3.4.5 Particulate Matter (PM,o and PM,.5)
Airborne particulate matter represents a complex mixture of organic and inorganic substances. Because of the complexity of particulate matter and the importance of particle size in determining exposure and human dose, multiple terms are used to describe particulate matter. (ISO 7708: 1995; EN 481,1991; EN 12341, 1995).

Most of the quantitative information available on the health effects of particulate matter comes from studies in which particles in air have been measured as PMlO. The large body of information on studies relating day-to-day variation in particulate matter concentrations to day-to-day variation in health provides quantitative estimates of the effects of particulate matter that are generally consistent.

3.4.6 Benzene
Benzene has low acute toxicity, but repeated exposure to very high concentrations can cause severe effects on the blood and blood-forming organs in humans. Benzene is known to be a human carcinogen. The most convincing relationship is found between benzene exposure and the development of acute non-lymphocytic leukaemia (Mowrer et 0/.,1996).

3.4.7 Polycyclic Aromatic Hydrocarbons
Polycyclic (or polynuclear) aromatic hydrocarbons (PAH) are complex mixtures of hundreds of

chemicals, including derivatives of PAH, such as PAH with a N02 group (nitro-PAH) and oxygenated products, and also heterocyclic aromatic compounds (Lindstedt et 0/., 1982).

The biological properties of most PAH are still unknown. Nevertheless, the available data, mostly from animal studies, indicate that several PAH may induce a number of adverse effects, such as immunotoxicity, genotoxicity, carcinogenicity and reproductive toxicity (affecting both male and female offspring). PAH may also influence the development of atherosclerosis.

3.4.8 Lead
Lead (Pb) toxicity can be explained by interactions with different enzymes, and that is why almost all organs can be considered as target organs for lead. A wide range of biological effects has been evidenced experimentally, including effects on haem biosynthesis, the nervous system, the kidneys, the reproductive organs, the cardiovascular system, the immune system, the liver, the endocrine system and the gastrointestinal tract [Cikrt et 0/., 1997).

3.4.9 Atmospheric Cadmium

Cadmium [Cd], whether absorbed by inhalation or via contaminated food, may alter kidney functioning in various ways. There is also sufficient evidence that cadmium can produce lung cancer in humans and animals exposed by inhalation, and the International Agency for Research on Cancer has classified cadmium as a c1ass-1 human carcinogen (Pekar et 0/., 1997).

4.0 Conclusion:

This study concluded with results that ambient air in Atchutaapuram is polluted. The major pollutants are Particulate matter (PMlO and PM,.,). Health effects caused by various air pollutants were informed to create awareness among people in Atchutaapuram. The study area covers a substantial portion of Atchutaapuram sez. The characterization of trace metal sources in the study area is quite challenging due to a large number of industrial and urban sources. The findings of this study may provide a comprehensive database for framing an appropriate strategy for necessary mitigative/preventive measures.

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