PRESENT STATUS OF AIR POLLUTION IN THE TOWN OF NELLORE-ACTION PLAN FOR LOWERING OF AIR POLLUTION & AIR POLLUTION – HEALTH EFFECTS.

Dr. Shaik. Annar , (**M.Sc, M.Ed, Ph.D)**
Lecturer in Chemistry,
Govt. Degree College,
Udayagiri, Nellore (Dt), A.P., India.

ABSTRACT

Air is the most important component of the environment. The quality of air that is inhaled is more important than the quality of water and food that is consumed, because, a person inhales about 16-20 kg of air per day. Any minute change in the composition of air is likely to bring about a change in the health of the individual. Air pollution due to road traffic is a serious health hazard and thus the persons who are continuously exposed, may be at an increased risk. Although several studies have confirmed the ill effects of air pollutants on the lung function of traffic policemen.

I review the data of air pollutants of Nellore town after consulting the Pollution Control Board, Transport, Civil Supplies, State Oil Co-ordinators etc. and then suggested an action plan for lowering of air pollution. And also review the human health effects of Air Pollution and the role of students to control the Air Pollution.

Key words: - Air pollution, Air pollutants, APPCB, Air Act 1981, Action Plan etc.

Introduction:-

Sri Potti Sri Ramulu Nellore District is one of the 23 districts of Andhra Pradesh. The population of the district was 2,966,082 of which 22.45% were urban as of 2011. Nellore city is its administrative headquarters. The district lies between 13 30’ and 15 6’ of Northern latitude and 70 5’ and 80 15’ of Eastern latitude. It is bordered by Bay of Bengal to the east, the state of Rayalaseema to the South, the district Kadapa , and the district of Prakasam to the north. The eastern side consists of area of low lying land extending from the base of the

Eastern Ghats to the sea. The west side of the district is separated from Cuddapah district by Veligonda hills. The district is split by the River Pennar and is located on both south and north banks of it. Nellore district occupies an area of 13,076 square kilometres (5,049 sq mi), comparatively equivalent to the Philippines Negros Island .

The air pollution is viewed as the most serious problem in many cities in India and accordingly Hon'ble Supreme Court of India has selected the cities depending upon the pollution load due to various activities. The transport sector is held largely responsible for the air pollution in the cities and the particulate matter is the most pollution causing agent in the cities. However, there are many other sources of the particulate emissions which include large industrial plants, medium and small scale industries, refuse burning, household burning biomass for cooking and heating, vehicular exhausts, re-suspended road dust, construction, particles migrating from other regions and naturally occurring dust. These sources emit the particles of different sizes of which the small particles are a cause of serious concern since they affect the public health more than the large particles.

Therefore, it is necessary to have a better understanding of the emissions from these sources so as to build a proper plan of action and a strategy to reduce the pollution due to particulate matters. This is the aim of this report and it highlights the steps that are required to be taken by the agencies who are participating in the implementation of this action plan.

WHO Report:-

As per the World Health Organisation (WHO) report, Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Household combustion devices, motor vehicles, industrial facilities and forest fires are common sources of air pollution. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulfur dioxide. Outdoor and indoor air pollution cause respiratory and other diseases, which can be fatal.

- Around 3 billion people cook and heat their homes using open fires and leaky stoves burning biomass (wood, animal dung and crop waste) and coal.

- Nearly 2 million people die prematurely from illness attributable to indoor air pollution from household solid fuel use.
- Nearly 50% of pneumonia deaths among children under five are due to particulate matter inhaled from indoor air pollution.
- More than 1 million people a year die from chronic obstructive respiratory diseases (COPD) that develop due to exposure to such indoor air pollution.
- Both women and men exposed to heavy indoor smoke are 2-3 times more likely to develop COPD.

Air quality is important simply because we can't avoid breathing the air around us. The average adult breathes in about 20 cubic meters, or 20,000 liters of air a day. Other planets have sunlight, but only our earth has air and water. Without all of these there would be no life. A diverse community of plant and animal life has thrived on this planet for millions of years, sustained by the sun and supported by the soil, water and air.

The air is made up of nitrogen and oxygen, with traces of other gases such as carbon dioxide, plus minute particles like dust. Although clean air should be freely available to all plant and animal life, humans have been gradually polluting it, putting their health at risk and the well-being of the earth itself.

Sources of Air Pollutants: -

Air pollutants mainly come from the discharges of gases and particles mainly from industry, motor vehicles and Biomass combustion. There are also natural sources such as wind-blown dust and smoke from bush fires. Some forms of air pollution create global problems viz., upper atmosphere ozone depletion and acid rain. The enhanced greenhouse effect also falls into this category.

Sulphur dioxide is a corrosive acid gas which combines with water vapour in the atmosphere to produce acid rain. Both wet and dry deposition has been implicated in the damage and destruction of vegetation and in the degradation of soils, building materials and watercourses. The principal source of this gas is power stations burning fossil fuels which contain sulphur.

Nitrogen oxides are formed during high temperature combustion processes from the oxidation of nitrogen in the air or fuel. The principal source of nitrogen oxides - nitric oxide (NO) and nitrogen dioxide (NO_2), collectively known as NO_x - is road traffic. NO and NO_2 concentrations are therefore greatest in urban areas where traffic is heaviest. Other important sources are power stations, heating plants and industrial processes.

SO2 and NOx concentrations in the NELLORE city for the year 2012

Table showing the seasonal variations of SO2 and NOx in NELLORE

	Industrial		Residential		Sensitive	
2007	**SO2**	**Nox**	**SO2**	**Nox**	**SO2**	**Nox**
Summer	8	30	9	30	8	30
Rainy	8	30	8	30	8	30
Winter	8	30	9	30	9	30

Conc in ug/m^3

Rapid industrial and economic growth of the developing countries in Asia has increased urbanization and population pressure on local and national governments to keep pace with urban environmental management systems to meet the needs of the expanding cities with numerous parameters for management. Air pollution abatement strategies, solid waste management plans, supply of water and control of wastewater and sewerage systems are the essentials of environmental management. In this energy plays a crucial role in all development plans to enable a livable city. Therefore, urban governance is challenged with the rapid globalization and the need to provide basic amenities to the population.

APPCB is assessing the ambient air quality in the state. A monitoring network with 60 ambient air quality-monitoring stations throughout the state are placed to assess the changes in air quality. In addition to it in Hyderabad continuous ambient air quality monitoring station has been installed. Based on the results of these monitoring stations, the government of A.P has taken preventive measures to control air pollution from different sources. APPCB is

monitoring the point source emissions regularly and directions to install / upgrade air pollution control equipment are given to the industries that are exceeding the standards.

Government of India has enacted the **Air (Prevention and Control of Pollution) Act 1981** to prevent and control the air pollution. The objective of this Act is to provide for the prevention, control and abatement of air pollution.

With increase in population, vehicle numbers, and fuel consumption pollution levels are also increasing in the Nellore town. Only sulphur dioxide levels have decoupled from the growth trend due to change in the energy matrix in the town. Nellore has its own evidences on insidious health effects of air pollution. Scientists have found high level of oxidative stress, lung function impairment, and respiratory ailments due to air pollution. Drug sales related to respiratory symptoms in key locations of Nellore have increased. Studies have predicted significant lives savings if air pollution is controlled. The city needs aggressive and sustained action to protect public health.

* Tiny particles are rising in the air. The levels are about 1.3 times the standards and falls in high pollution class – according to the air pollution classification of the Central Pollution Control Board.
* During the winter months the tiny particles PM2.5 shoot much beyond the standards. They go deep inside the lungs.
* The recent tightening of the national ambient air quality standards have changed the air quality status of the locations in the city. Some of them have moved from low and moderate to high pollution bracket.
* Air toxics like benzene that are strong carcinogen have recorded levels above the permissible limit.

Govt. of India has enacted Air (Prevention & Control of Pollution) Act in 1981. The responsibility has been further emphasized under Environment (Protection) Act, 1986. It is necessary to assess the present and anticipated air pollution through continuous air quality survey/monitoring programs. Therefore, Central Pollution Control Board had started National Ambient Air Quality Monitoring (NAAQM) Network during 1984 - 85 at national level. The programme was later renamed as National Air Monitoring Programme.

Air (Prevention and Control of Pollution) Act 1981

Government of India enacted the Air (Prevention and Control of Pollution) Act 1981 to arrest the deterioration in the air quality. The act prescribes various functions for the Central Pollution Control Board at the apex level and State Pollution Control Board at the state level. The main functions of the Central Pollution Control Board are as follows:

1. To advice the Central Government on any matter concerning the improvement of the quality of the air and the prevention, control and abatement of air pollution.
2. To plan and cause to be executed a nation-wide programme for the prevention, control and abatement of air pollution.
3. To provide technical assistance and guidance to the State Pollution Control Board.
4. To carry out and sponsor investigations and research related to air pollution prevention, control and abatement of air pollution.
5. To collect, compile and publish technical and statistical data related to air pollution; and

The main functions of the State Pollution Control Board : -

- To plan a comprehensive programme for prevention, control or abatement of air pollution.
- To advise the State Government on any matter concerning prevention, control and abatement of air pollution.
- To collect and disseminate information related to air pollution.
- To collaborate with Central Pollution Control Board in programme related to prevention, control and abatement of air pollution; and
- To inspect air pollution control areas, assess quality of air and to take steps for prevention, control and abatement of air pollution in such areas.

National Air Quality Monitoring Programme (N.A.M.P.)

Central Pollution Control Board initiated National Ambient Air Quality Monitoring (NAAQM) programme in the year 1984 with 7 stations at Agra and Anpara. Subsequently the programme was renamed as National Air Monitoring Programme (N.A.M.P.). The number of

monitoring stations under N.A.M.P. has increased, steadily, to 308 operating stations by 2006 covering 115 cities/towns in 25 States and 4 Union Territories of the country.

Objectives

The objectives of the N.A.M.P. are as follows:

To determine status and trends of ambient air quality;

To ascertain whether the prescribed ambient air quality standards are violated;

To Identify non-attainment Cities where air pollutants are exceeded prescribed standards.

To obtain the knowledge and understanding necessary for developing preventive and corrective measures.

Under N.A.M.P., four air poll.utants *viz*., Sulphur Dioxide (SO2), Oxides of Nitrogen as NO2 and Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM/PM10), have been identified for regular monitoring at all the locations.

The monitoring of pollutants is carried out for 24 hours (4-hourly sampling for gaseous pollutants and 8-hourly sampling for particulate matter) with a frequency of twice a week, to have 104 observations in a year. N.A.M.P., being a nationwide network, involves several agencies which are Central Pollution Control Board: in Delhi; State Pollution Control Boards: in the respective States; Pollution Control Committees: in the respective Union Territories and National Environmental Engineering Research Institute (NEERI), Nagpur: in 6 metro cities of the country.

CPCB co-ordinates with these agencies to ensure the uniformity, consistency of air quality data and provides technical and financial support to them for operating the monitoring stations. Since the target sampling of 24 hours in a day could not be fulfilled at all the locations due to power failures etc., the values monitored for 16 hours and more are considered as representative values for assessing the ambient air quality for a day. The target frequency of monitoring twice a week, 104 days in a year could not be met in some of the locations, in such cases 40 and more days of monitoring in a year is considered adequate for the purpose of data analysis. The outliers from the data were removed. N.A.M.P. is being operated through various monitoring agencies, large number of personnel and equipment are involved in the sampling, chemical analyses, data reporting etc. It increases the probability of variation and personnel

biases reflecting in the data, hence it is pertinent to mention that these data be treated as indicative rather than absolute.

Non-attainment Areas

The air quality terms is expressed in terms of low, moderate, high and critical for various cities/towns monitored. The concentration ranges for different levels have been selected based on the Notified Standards for different pollutants and area classes by calculating an Excedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard). The Excedence Factor (EF) is calculated as follows:

$$\text{Excedence Factor} = \frac{\text{Observed annual mean concentration of a criterion pollutant}}{\text{Annual standard for the respective pollutant and area class}}$$

The four air quality categories are:

Critical pollution (C): when EF is more than 1.5;

High pollution (H): when EF is between 1.0 - 1.5;

Moderate pollution (M): when EF between 0.5 - 1.0; and

Low pollution (L): when EF is less than 0.5.

Action plan for control of Air Pollution

The aim of the action plan is to identify and implement a least- cost package of measures to improve air quality, such that the marginal costs equals the marginal benefits. Authorities responsible for preparing action plans regarding control of air pollution in their respective cities base their decisions on subjective assessment of economic and social costs, benefits, feasibility and other considerations.

Proposed Action Plan

Vehicular Pollution

The salient features of actions plan to control vehicular pollution are as follows:

1. Bharat Stage –III emission norms will be implemented for all categories of 4-wheeled vehicles . Supply of the commensurate fuel will also be done accordingly.
2. All in-use petrol driven 3 wheelers to be converted to LPG .

3. In respect of 'No Fuel without PUC,' programme, a Committee consisting of RTA concerned and the Traffic Police in mobile teams is proposed under the overall supervision of the Transport Commissioner has been constituted. The committee is empowered to check all visibly polluting vehicles including RTC and SETWIN buses. The teams will also verify PUC certificates issued without proper check and the source of such certification, so that action can be taken comprehensively.

4. Phasing out of older vehicles was required to be taken but in the absence of specific orders from the apex courts directing the government for amending the CMV act, it may not be legally feasible to phase out vehicles based on their age.

5. Issue of Necessary amendment of Motor Vehicle Act to apprehend and penalize the use of adulterated fuel .

6. To augment existing pre- mixed 2T oil petrol outlets.

7. To augment number of PUC Centers along with increase in tariff for emission testing.

8. To implement emission norms in accordance with the road map proposed by the expert committee on Auto Fuel Policy.

9. Euro IV equivalent emission norms for all private vehicles, city public service vehicles and city commercial vehicles .

10. Bharat stage-III emission norms for all categories of 2 & 3 wheelers preferably .

Supply of fuel quality for both diesel and gasoline which is commensurate with the emission norms implemented.

11. Augmentation of city public transport system to be undertaken by the State Government after reviewing the start up schedules and estimated impact of metro rail system.

12. Emission norms for city public service vehicles for City Buses, Taxis & 3 Wheelers, emission norms have already been set under the directions of the Supreme Court.

13. A number of additional measures will be taken to reduce vehicular pollution by providing CNG buses, strengthening the Pollution Under Control (PUC) system, introduction of strict inspection and Certification Systems and promotion of advanced technologies. Special focus will be on safety certification and stringent inspection of all transport vehicles. A safety council to set standards for vehicle safety and fitness is being set up shortly.

14. A number of flyovers, bridges and pedestrian subways are under construction and many more are being contemplated. In addition, existing roads are being widened and new roads constructed.

Integration of all modes of transport is necessary to achieve the potential of each mode. Feeder systems to metro and commuter rail will be provided. Facilities for parking of personalized modes, autos and taxis are proposed at all stations. Time table and fare integration for metro rail and buses are also contemplated.

Health effects of air pollutants

Some of the common health effects caused due to increase in air pollutants are Allergic bronchitis, acute bronchial asthma, chronic bronchitis, emphysema, COPD (chronic obstructive pulmonary diseases), rhinitis, laryngitis, sinusitis, pneumonia and common cold.

PARTICLES (PM_{10})

Sources

Unlike the individual gaseous pollutants which are single, well-defined substances, particles (PM 10) in the atmosphere are composed of a wide range of materials arising from a variety of sources. Concentrations of PM 10 comprise of primary particles, arising from combustion sources (mainly road traffic); secondary particles, mainly sulphate and nitrate formed by chemical reactions in the atmosphere; and coarse particles, suspended soils and dusts, seasalt, biological particles and particles from construction work.

Health effects

Particulate air pollution is associated with a range of effects on health including effects on the respiratory and cardiovascular systems, asthma and mortality. EPAQS concluded that particulate air pollution episodes are responsible for causing excess deaths among those with pre-existing lung and heart disease, and that there is a relationship between concentrations of PM 10 and health effects, such that the higher the concentration of particles, the greater the effect on health.

SULPHUR DIOXIDE

Sources

Carbon monoxide (CO) is a gas formed by the incomplete combustion of carbon containing fuels. In general, the more efficient the combustion process, the lower the carbon monoxide

emission. The main outdoor source of carbon monoxide is currently road transport, in particular petrol-engined vehicles.

Health effects

The main threats to human health from exposure to carbon monoxide are the formation of carboxyhaemoglobin, which substantially reduces the capacity of the blood to carry oxygen and deliver it to the tissues, and blockage of important biochemical reactions in cells. People who have an existing disease which affects the delivery of oxygen to the heart or brain (eg coronary artery disease (angina)) are likely to be at particular risk if these delivery systems are further impaired by carbon monoxide.

NITROGEN DIOXIDE

Sources

All combustion processes in air produce oxides of nitrogen. Nitrogen dioxide (NO_2) and nitric oxide (NO) are both oxides of nitrogen and together are referred to as NO_X . It is nitrogen dioxide which is associated with adverse effects upon human health. Road transport is thought to account for about 50% of total emissions of nitrogen oxides.

Health effects

At relatively high concentrations, nitrogen dioxide causes inflammation of the airways. There is evidence to show that long-term exposure to nitrogen dioxide may effect lung function and that exposure to nitrogen dioxide enhances the response to allergens in sensitised individuals.

OZONE

Sources

Ozone is not emitted directly from any man-made source in any significant quantities. It arises from chemical reactions in the atmosphere caused by sunlight. In the stratosphere, where ozone plays a beneficial role by shielding the earth from harmful ultra-violet radiation, ozone is produced by sunlight acting initially on oxygen molecules. The balance between ozone and oxygen in the stratosphere is currently being disturbed by migration upwards of chemicals such

as chlorofluorocarbons. They remove ozone and may therefore increase the amount of ultra-violet light reaching the earth's surface. Some ozone occasionally reaches the lower layers of the atmosphere from intrusions of air from the stratosphere. But it is primarily formed by a complicated series of chemical reactions initiated by sunlight. Oxides of nitrogen and VOCs, derived mainly from man-made sources, react to form ozone. These substances are produced bycombustion, other industrial processes, and other activities such as solvent use, and petrol distribution and handling. NO X and VOCs are the most important precursors of elevated levels of ozone. Production can also be stimulated by carbon monoxide, methane, or other VOCs which arise from plants, trees and other natural sources. Ozone is also a greenhouse gas, so NO X and VOCs can also be considered indirect greenhouse gases.

Health effects

Exposure to high concentrations of ozone may cause slight irritation to the eyes and nose. If very high levels of exposure (1,000-2,000µg/m^3) (500-1,000ppb) are experienced over several hours, damage to the airway lining followed by inflammatory reactions may occur. There is also evidence that minor changes in the airways may occur at lower concentrations, down to about 80ppb (160µg/m 3).

Benzene

Sources

Benzene is a volatile organic compound. The main atmospheric source is the combustion and distribution of petrol, of which it is a minor constituent. Benzene is also formed during the combustion process from aromatics in the petrol. Diesel fuel is a relatively small source.

- Petrol-engined vehicle exhausts;
- Petrol refining and distribution; and
- Uncontrolled emissions from petrol station
- Forecourts without petrol vapour recovery systems.

Health effects

Benzene is a recognised genotoxic human carcinogen. Studies of industrial workers exposed in the past to high levels of benzene have demonstrated an excess risk of leukaemia which

increased in relation to their working lifetime exposure.

1,3-BUTADIENE

Sources

1,3-Butadiene is a gas at normal temperatures and pressures and trace amounts are present in the atmosphere, deriving mainly from the combustion of petrol and of other materials. Although 1,3-butadiene is used in industry, mainly in the production of synthetic rubber for tyres, motor vehicles are its dominant source.

Health effects

The health effect which is of most concern in relation to 1,3-butadiene exposure is the induction of cancers of the lymphoid system and blood-forming tissues, lymphomas and leukaemias. Like benzene, 1,3-butadiene is a genotoxic carcinogen

LEAD

Sources

Lead is the most widely used non-ferrous metal and has a large number of industrial applications, both in its elemental form and in alloys and compounds. The single largest use globally is in the manufacture of batteries. The use of unleaded petrol has led to significant reductions in urban lead levels. Food and water are two of the main sources for most people. Lead in air contributes to lead levels in food through the deposition of dust and rain, containing the metal, on crops and on the soil.

Health effects

Exposure to high levels of lead may result in toxic biochemical effects in humans which in turn cause problems in the synthesis of haemoglobin, effects on the kidneys, gastrointestinal tract, joints and reproductive system, and acute or chronic damage to the nervous system. The possible effect of lead on brain development in children, and hence their intellectual development, is the greatest cause for concern.

Copper: Poison to humans by ingestion. Inhalation of copper dust and fume causes irritation in the respiratory tract. Absorption of excess copper results in "Wilson's disease" due to deposition of copper in the brain, skin, liver, pancreas and myocardium.

Cadmium: Can be poisonous to humans by inhalation, ingestion, intraperitonial, sub-cutaneous, intra-muscular and intravenous routes. Cadmium absorption can damage the kidneys and can cause anaemia. It is a potential human carcinogen. Cadmium causes increased blood pressure and a disease called "Itai--Itai", which makes bones brittle resulting in multiple fractures.

Nearly 2 million people a year die prematurely from illness attributable to indoor air pollution due to solid fuel use . Among these deaths, 44% are due to pneumonia, 54% from chronic obstructive pulmonary disease (COPD), and 2% from lung cancer.

Pneumonia

Nearly half of deaths among children under five years old from acute lower respiratory infections (ALRI) are due to particulate matter inhaled from air pollution from household solid fuels (WHO, 2009).

Chronic obstructive pulmonary disease

Women exposed to heavy indoor smoke are three times as likely to suffer from chronic obstructive pulmonary disease (e.g. chronic bronchitis), than women who use cleaner fuels. Among men (who already have a heightened risk of chronic respiratory disease due to their higher rates of smoking), exposure to indoor smoke nearly doubles that risk.

Lung cancer

Approximately 1.5% of annual lung cancer deaths are attributable to exposure to carcinogens form indoor air pollution. As with bronchitis, the risk for women is higher, due to their role in food preparation as well as their comparatively lower rates of smoking. Women exposed to indoor smoke thus have double the risk of lung cancer in comparison with those not exposed.

Other health impacts

More generally, small particulate matter and other pollutants in indoor smoke inflame the airways and lungs, impairing immune response and reducing the oxygen-carrying capacity of the blood.

There is also evidence of links between indoor air pollution and low birth weight, TB, ischaemic heart disease, nasopharyngeal and laryngeal cancers.

References:

1. Reports of APPCB , Nellore and Hyderabad.
2. Indoor air pollution and hold energy, WHO.
3. (1988) The role of biogenic hydrocarbons in urban photochemical smog: Atlanta as a case study. Science **241**:1473–1475.
4. (2007) *Climate Change 2007: The Physical Science Basis*, ed Solomon S, et al. (Cambridge Univ Press, Cambridge, UK).
5. (2002) A satellite view of aerosols in the climate system. Nature **419**:215–223.