CHAPTER II

ESSAY

Motor Vehicle Emissions: A Major Cause of Lead Poisoning to the Public School Children of Kathmandu Valley, Nepal

2.1 Problem Identification,

The capital city of Nepal, Kathmandu, has already reached higher ambient levels of most pollutants and the quality of air has considerably deteriorated to a critical level in recent times (Shahi,1994). In particular, suspended particulate matter (SPM) and carbon monoxide (CO), nitrogen dioxide (NO2), sulphur dioxide (SO2), and Lead (pb) concentrations in many areas are higher than ambient air quality standards (AAQS). These pollutants are showing rising trend. Chronic traffic congestion in the valley as well as different types of vehicles are causing alarming level of CO, black smoke and hydrocarbons (HC). These types of gases are all harmful to public health. (Figure - 2.2)

Due to the geographical location of Kathmandu Valley, the polluted air always remains and circulates within the valley. Furthermore, there is no restriction on old vehicles which emits more black smoke. Import and distribution of low quality of fuels and leaded fuels as well as poor condition of road (Appendix S) are also seen as responsible factors. The speedy rise in the number of vehicles

(Appendix F,G,H,I,J,and K) is associated with the increasing number of population (specially by migration) in the constant length of road are also not the least important reason to create air pollution in Kathmandu Valley. Lack of drainage to both side of road, irregularity on motor-vehicle emission test, lack of adequate transport, road and urban planning policy are also played the vital role to make air pollution in Kathmandu valley of Nepal.

The level of air and noise pollution in the core city area of Kathmandu is significantly high with possible health hazard risks on the residents. The level of dust concentration in the air is found in the study is 1053 μg/m3 which is 2-6 times higher than the acceptable level set by World Health Organization (NESS, 1995) . According to the WHO air quality guidelines, the acceptable level is 230 μg/m3 for total suspended particles for 24 hour averaging period. The risky level of dust in the air may cause the ailments like common cold, cough, asthma, sore throats, bronchitis and reduces visibility. So, it is necessary to control the haphazard waste disposal, road maintenance, improvement in traffic management system, effective vehicle emission control and phasing out of old vehicles. (The Rising Nepal, June 4, 1997)

There are only 12 zonal Transport Management offices involved to registered the vehicles among 14 zones of Nepal (Appendix N). Rest of 2 zones have no Transport Management Offices because one has not linked by the road yet and another zone was just linked 2 years ago. Till February 1996, there had been registered more than 162,000 of vehicles all over the country. Out of these total vehicles, more than 60

% are registered (in Bagmati Zonal Office) and run within the valley. Among these 12 zones, Kathmandu Valley lies in Bagmati zone. Since the last couple of years, traffic volume in the street of Kathmandu has increased but the condition of roads have not been improved. At present daily more than 110,000 vehicles ply on the streets of Kathmandu valley (Appendix O). The vehicles are the main sources of air pollution which contribute in two ways - from vehicular emission and by re-suspension of dust from road surfaces.

The total road length within the valley is approximately 943 km. (DOR,1995). Most of the roads are two lane and narrow with an average width of 4.6m. The total length of the road has not expanded with the increase of population and number of vehicles. Hence urban roads can not cope with the increasing traffic volume. About 60 % of the city streets are metalled but the condition of the most of the metalled streets, even in the city area, is very poor. This contributes the atmospheric dust pollution due to resuspension of street dust by vehicular movements.

Because of the capital city and centralization of all economic and political activities, and the more opportunity for employment, people of other parts of the country like to migrate to Kathmandu Valley. The rate of migration to valley from other parts of the country (internal migrants) and foreign born migrants are in increasing trend. In 1981, there was 3,266 foreign born migrants and 37,134 internal migrants to the valley. The number of migrants in 1991 was reached 16,134 and 98,543 respectively (United Nations, 1995). The valley covers the three disricts (Kathmandu,

Lalitpur and Bhaktapur) of the country among 75 districts in total. According to population census in 1991 there was 11,05,379 population. The estimated population for 1996 is 13,08,798 and 2001 is 15,19,974 (CBS, 1996). Within the area of 900 sq. km of valley, more than 60% of total vehicles runs. The high rate of increasing number of vehicles (Appendix F) as increased population is becoming a major cause of air pollution problem.

These all of above mentioned conditions are the basic causes of rising trends of air pollution problem. If we do not consider it and do not start the application of intervention, it will not only affect to the individual health rather to collapse all development activities and human civilization. Everything is done for the welfare of human beings but if there is no consideration to control air pollution in any development activities, ultimately, that will not be favourable to human beings and not be sustainable too. Some of the problems are limited within the boundary of society,country and zone but such types of problems, i.e., air pollution is not limited within the boundary of society and country. In conclusion, the problem of air pollution must be controlled at the place where it is produced and developed.

2.2. Severity of the Problem

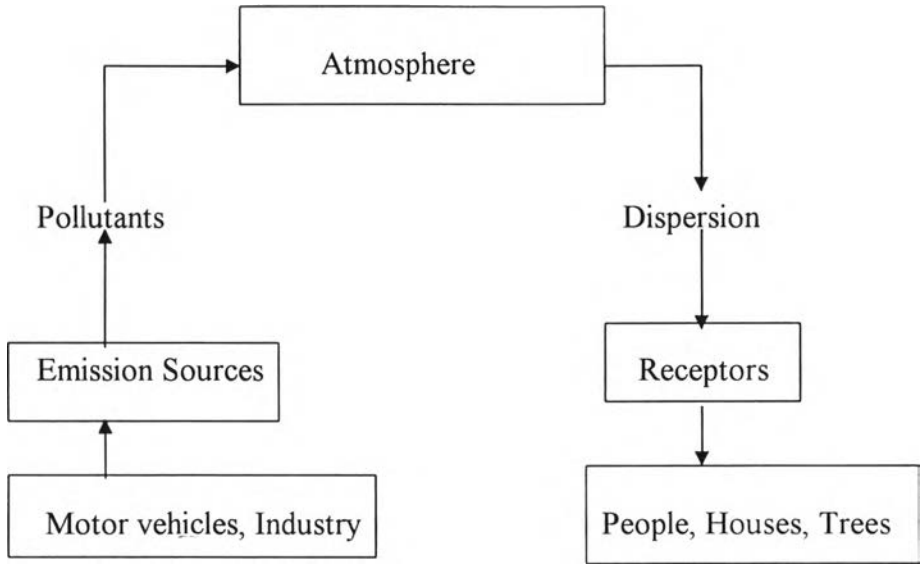
Environmental degradation may cause allergic or irritating reactions, acute poisoning, chronic diseases, accumulation of toxic substances in body tissues and fluids, dermatitis, reproductive and birth defects and neurobehavioural impairment. Workplace

conditions and environmental such as crowding and noise contribute to psychological disorders as well as injuries and diseases.

Each and every moment human being, animal and plant requires air which is an unavoidable and cost-free element. It enters the lungs of men through respiration. The worst quality of air effects human health in a short period through respiration. Because of the worst quality of air in Kathmandu valley of Nepal, number of children admitting to the hospital for respiratory problem is increasing dramatically since the last few months, i.e., 2674 children were admitted only in the Kanti Children Hospital. (Explore Nepal, 6 Jan,1998)

Air affects to all kinds of things by interaction. Through the ambient air, each and everything is connected to the eco - system. If one thing or parts of the eco - system is affected by air, then it will affect to other parts of the system. Bad quality of air could affect all living things as the following system.

Figure-2.1: Air Pollution Mechnism



Source: Park, 1994.

There is no organization or institution to measure the ambient air quality and no any intervention has been applied to control the air pollution in the Kathmandu Valley, Nepal. Lack of adequate legal provision to control air pollution, transport policy and motor-vehicle policy are also major causes of the air pollution problem seriousness.

The major health effects of air pollutants are Asthma, Chronic Bronchitis, Heart and Lung disease, Impair Neurobehavioural function and Impair Learning Ability of children. Ultimately, these health effects increases the mortality and morbidity of the people.

2.3. Environmental Affecting Factors of Human Health.

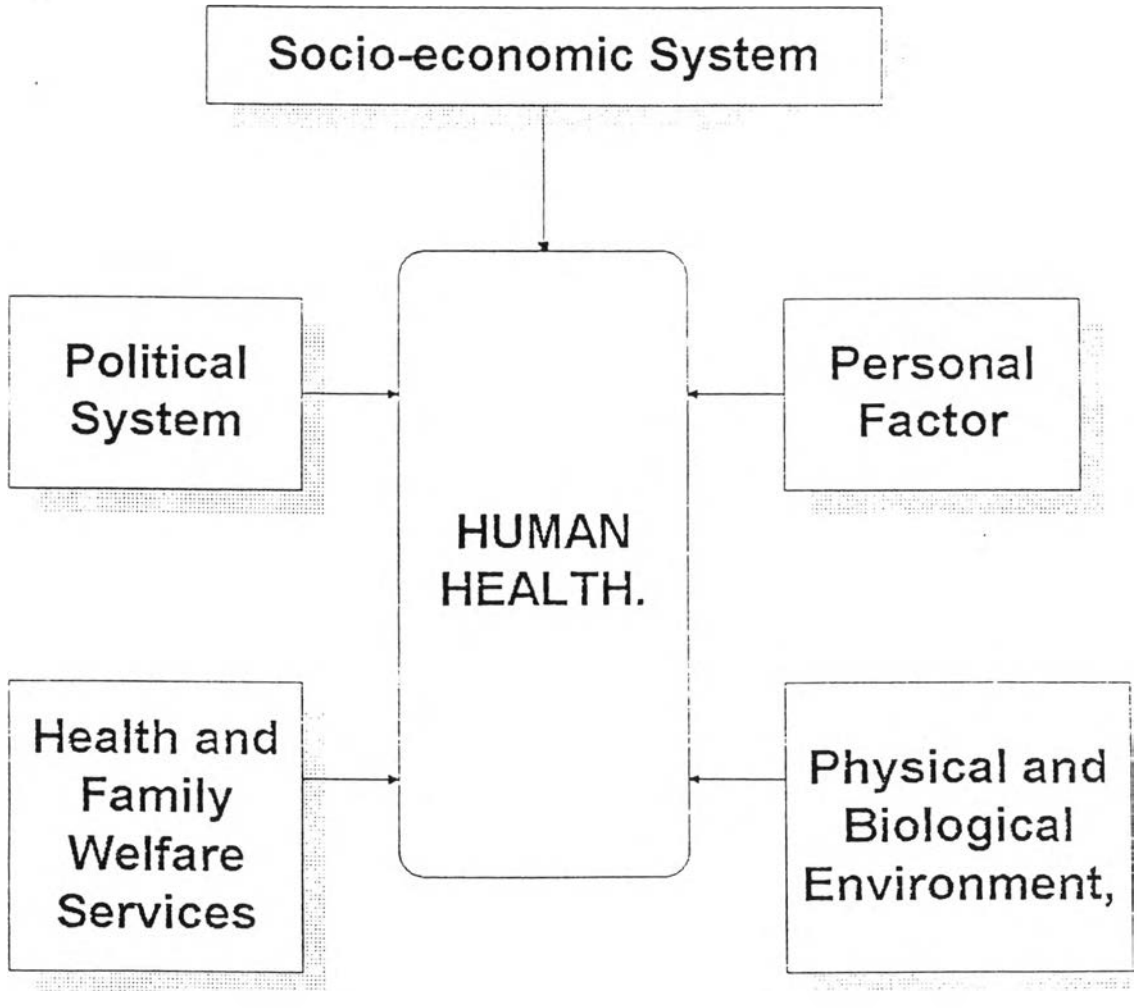
Health is multifactorial. The status of health depends on personal factors as well as environmental factors. All environmental factors like the political, economic, socio-cultural, physical and biological systems influence health. The interaction of people's personal factors and their environmental factors determines their health status.

The mutual relationships between living organism and their environment is called the eco-system. Man is also a part or subsystem of the eco-system. Each and every part of the system is being affected by other parts. Human eco-system includes natural environment and man-made environments - physical, chemical, biological and psychological. So human health is visualised as a state of dynamic equilibrium between man and his environment.

Through the industrialisation, urbanisation, deforestation, land reclamation, construction of irrigation canals and dams and motor vehicle emission, man is creating himself new health problems. It is now being increasingly recognised that environmental factors and ecological considerations must be built into the total planning process to prevent degradation of eco-system. Prevention of disease through ecological or environmental manipulations or interventions is much safer, cheaper and more effective rational approach than all the other means of control. Man's capacity to adapt himself only in so far as the mechanisms of adaptations are potentially present in his genetic code.

Conceptual framework on affecting factors of environment for human health

Figure-2.2. Environmental Affecting Factors for Human Health.



Source: Park, 1994

2.3.1. Personal Factors

Heredity, age, sex, behaviour, lifestyle occupation and education are the personal factors which affect health. Some of the diseases are now known to be of genetic origin, e.g. chromosomal anomalies, errors of metabolism, mental retardation etc. Some of the diseases are age-and sex-specific. Individual behaviour/ habit, lifestyle and education has also plays the vital roles to the determination of health.

Lifestyle is the living way of people. It reflects a whole range of social values, attitudes and activities. It is composed of cultural and behavioural patterns and life long personal habits that have developed through processes of socialization. Lifestyles are learnt through social interaction with parents, peers, groups, friends and through school and mass media. (Park, 1994)

Health requires the promotion of healthy lifestyle. Nowadays, in many developed countries have the health problem of coronary heart disease, obesity, lung cancer, drug addiction etc. which are associated with changes of lifestyle. In developing countries, where traditional lifestyle is existed and risk of illness and death are connected with lack of sanitation, poor nutrition, personal hygine, elementary human habits, customs and cultural patterns.

Lifestyle included adequate nutrition, enough sleep, sufficient physical activity actually promotes the health. The achievement of optimum health demands adoption of

healthy lifestyles. Health is both the consequence of an individual's lifestyle and external environment.

The nature of occupation also determines the status of health. People employed in productive work promotes health because unemployed usually show a higher incidence of illhealth and death. Loss of work may mean loss of income and status. It can cause psychological and social damage. (Park, 1994)

Air pollution enters to human body by two ways - ingested and inhaled. Although air pollution is equally scattered in particular place but the person could prevent themselves by using mask, stay in top floor (as far as possible) or far from busy roadside. Furthermore, if particular people have balanced diet or sufficient iron and calcium, then he would not obsorb air pollution especially lead pollutant. Like this, those person who do not make clear their hand before eat, they may inhaled air pollutant with their food. So personal factor also plays the vital role to affect the public health. (ATSDR, 1992)

2.3.2. Political System

Health is also related to the country's political system. Main obstacles to the implementation of health technologies are concerned with political system. Decisions concerning resource allocation, manpower policy, choice of technology and the degree to which health services are made available and accessible to different segment of the society are the examples which the political system can shape community health

services. The percentage of GNP spent on health is a quantitative indicator of political commitment. To achieve the goal of health for all WHO has set the target of at least 5 % expenditure on each country's GNP on health care (Park, 1994). Political commitment and leadership should orient towards social development and not merely economic development. If poor health patterns are to be changed, then entire socio-political system will changed in any given community. Social, political and economic actions are required to eliminate health hazards in people's working and living environments.

To reduce the air pollution, the political system, i.e., public policy could also play the vital role. If the government is more conscious about the health effects of air pollution, then it can apply the adequate policies, i.e., tax, custom might be effective to reduce the pollution level by encouraging the pollution free vehicles and discouraging pollution oriented vehicles.

2.3.3. Socio-economic System

Most of the people's health status is determined primarily by their level of socio-economic development, e.g., percapita GNP, education, nutrition, employment, housing. In many developing countries, economic progress has been the major factor in reducing morbidity, increasing life expectancy and improving the quality of life. The economic status determines the purchaging power, standard of living, quality of life, family size and pattern of disease and behaviour in the community. Except it, economic status also an important factor in seeking health care.

2.3.4. Health and Family Welfare Services

It is also a part of external environment. Health services is seen as essential for social and economic development. It covers the wide range of personal and community services for treatment of diseases, prevention of illness and promotion of health. The purpose of health services is to improve the health status of population. To be effective, the health services must reach the social peripheri, equitably distributed, accessible at a cost the country and community can afford and socially acceptable. There is strong correlation between GNP and expectation of life at birth. A sound and effective health services could improve the health of the people.

2.3.5. Physical and Biological Environment

Climate, location, water, air, lighting, noise and other physical facilities (Transport, Communication) also affects to the status of health. Physical and biological environment has a direct impact on physical, mental and social wellbeing of those living in it. Such environmental factors range from housing, water supply, psycho-social stress and family structure.

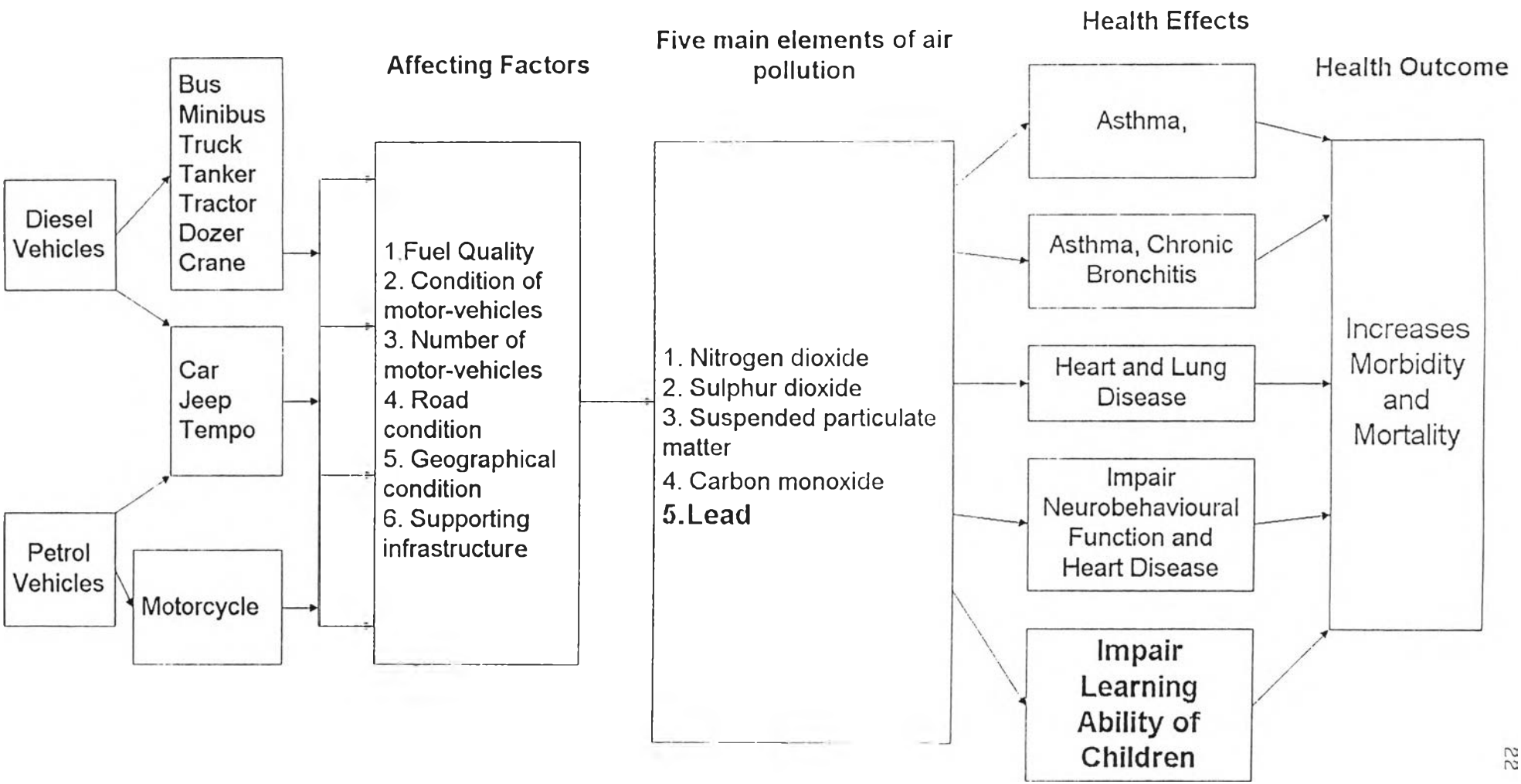
Other factors like-food , agriculture, industry, social welfare, rural development, adoption of policies in the economic and social fields, employment opportunities, wages, prepaid medical program and family support system also dtermines the status of health. In short, medicine is not the sole contributor to the health and wellbeing of the population. The potential of intersectoral contributions to the health of communities is increasingly recognised.

2.4. Main Factors to Increase the Air Pollution by Motor vehicles in Kathmandu Valley

The valley covers the three districts of the country- Kathmandu, Lalitpur and Bhaktapur. Because of valley, surrounded by hills, the limited number of vehicles could also affect to the ambient air quality standard. Aside from this, political, economical and educational concentrations in the valley have played a major role in the deterioration of the air quality. There are various factors to increase the problem of air pollution by motor- vehicles in Kathmandu valley, which specially deteriorated the biological and physical environment of macro system. They are as follows (Figure 2.3).

Conceptual framework on motor-vehicle air emission

Figure-2.3 Cause and Consequences of Air Pollution by Motor - Vehicle Traffic in Kathmandu Valley of Nepal.



2.5.1. Old Engined vehicles and Three wheelers

There are no restriction to run the old vehicles. Even the more than 30- year old vehicles are also allowed to run the city streets. Besides it, Three wheelers called "Tempo" in Nepal produces more black smoke in comparision with other diesel motor vehicles, are also allowed to run till now. Since 1991 this type (Tempo) of vehicle are not allowed to register but those which are already register before 1991 are getting permission to run within in the Kathmandu valley. All of the diesel Tempos that underwent the emission test failed. These diesel tempos have inefficient engine in terms of pollution control and they are also lacking regular servicing and maintenance. (The Rising Nepal, 23 July, 1997)

2.5.2. Use of Leaded and Low Quality Fuel

Because of the lack of monitoring and supervision, there exists supply of low quality fuel to the motor vehicles, additionally every kinds of vehicles are using leaded fuel which has been, already banned in other developed and developing countries, also a major cause to affect the ambient air quality. In Nepal, gasoline used by the vehicle is 87 octane which contains about 0.58 gm Pb/lit.Of fuel . The Tetraethyl Lead (TEL) $(C_2H_5)_4Pb$ is an anti knocking additive to gasoline in internal combustion engine of the vehicles. Since, Pb is not used in the combustion process, it is released into the atmosphere as airborne lead particulate through the exhaust, generally as lead oxide or lead chloride. Lead particulates are usually deposited few tens of metres away from the street. However, in turbulent air conditions dispersion over an wide area can be expected. At 1993, when there were 80,000 vehicles in Kathmandu, and on an average

nearly 60,000-72,000 litres of gasoline was consumed daily as vehicular fuel (sales record Nepal Oil Corporation, 1994). If this daily consumption record is assumed to be consistent, nearly 15 tonnes of Pb dust annually is released into the valley's atmosphere from the vehicles only. Even if 30 % of the lead particulate is retained in the exhaust pipe of vehicles, nearly 10 tonnes of pb dust gets its way into the atmosphere of the valley.

The road network within the valley is mostly confined to the municipal areas of Kathmandu and Lalitpur and therefore the probability of lead pollution is high. There are no effective street dust cleaning measures in both municipalities. As a result accumulation and enrichment of lead in the street dust is a common phenomenon. Resuspension of leaded street dust, thus, adds another dimension to air pollution in Kathmandu.(NESS,1995).

2.5.3. The Poor Condition of Road

Most of the city roads are not in good condition. Out of the total city road 394k.m. there is only 231k.m. are black topped and rest of the road condition is either gravelled or earthern (NPC/CBS,1995) . In such types of road condition the vehicles could not run smoothly which has been also a cause of air pollution. Because of the lack of infrastucture like drinage and side path ways the roads are more dusty in sunny days and muddy in rainy days. In sunny days, there is resuspended more dust particulate in the road.

2.5.4.Geographical / Meterological Condition

Geographically, Kathmandu is situated in the valley at the height of 1336m. and surrounded by hills. Because of valley, the polluted air could not flow easily outside the valley as in the plain lands happens. The stagnation of air in the Kathmandu valley is also became a cause of poor air quality.

Concentration of air pollutants also depends upon meteorological conditions. Although the Earth's atmosphere extends to several layers above the surface, it is only the first 30 km. that hold the major portion of the atmospheric gases. And man is most directly concerned with only the first 8-10 km. of the atmosphere. Among the meteorological factors, winds and temperature play a major part in the dissemination of air pollutants. Winds help carry pollutants from place to place. If the winds are weak and calm, pollutants concentrate; if they are strong and turbulent, they disperse. In case of Kathmandu valley, the pollutants are more concentrated because of stagnation of air.

2.5.5. Rising Number of Vehicles

In comparision with other zones and districts of the country, Kathmandu valley comprises the high volume of vehicle registration number (Appendix F). Out of total, more than 60 % motor-vehicles are registered and run within the valley.

2.5.6. Lack of Supporting Infrastructure

Lack of sufficient zebra crossing, overhead crossing bridges, Road signs, Traffic signs and signals and parking spaces has created the obstacles in the constant flow of

the vehicles. When motor vehicles could not flow smoothly, they emit more black smoke.

2.6. Normal Compositon of External Air

Air is a mechanical mixture of different kinds of gases. The normal composition of external air by volume is approximately as follows :

Nitrogen	78.00%
Oxygen	20.93%
Carbon Dioxide	0.03%
Others	1.04 %(argon, neon, krypton, xenon, and helium)

Besides it, air also contains water vapour, traces of ammonia and suspended matter such as dust, bacteria, spores and vegetable debris. Under ordinary conditions, the composition of outdoor air is remarkably constant. This is brought about by certain self cleansing mechanisms which operate in nature such as the movement of air, atmospheric temperature, sunlight, rain, the chemical effect of oxygen and plant life. When the rate of pollution becomes too high or when the cleansing process becomes ineffective, it constitutes a health hazard. (Park, 1994)

2.7. Rising Trends of Teperature in Kathmandu valley

One of the main results of air pollution is to rise in the temperature. The maximum and minimum temperature of Kathmandu valley is increasing year by year. The rising difference between maximum and minimum temperature is a indicator of

deteriorating ambient air quality. According to Statistical Pocket Book 1996, CBS, Nepal; the trend of increasing temperature since 1990 are as follows:

Table - 2.1

Year	Maximum	Minimum
1990	31.5 C.	-1.5 C
1991	32.1 C.	-1.2 C
1992	34.6 C.	-2.2 C

2.8. Health Effects by Air Pollution,

2.8.1. Immediate Effects

Epidemiological studies have shown that a sudden increase in air pollution has often been associated with immediate increase in the mortality and morbidity. The symptoms are usually referable to the respiratory system. Even a small increase in air pollution has been shown to be accompanied by a small but definite increase in mortality and morbidity. (Park, 1994)

2.8.2. Delayed Effects

The diseases currently suspected of being casually related to air pollution are chronic bronchitis and primary lung cancer.

2.9. Health Effects of Vehicle Pollution

In case of the Kathmandu valley, Nepal the rate of air pollution by vehicles are very high and it is increasing day by day which has been leaded to the problem of Public Health. Motor vehicles contribute to air pollution by emitting- hydro carbons(HC) , carbon monoxide (CO), lead and nitrogen oxides(NO2). In strong sunlight, certain of

these hydro carbons and nitrogen oxides may be converted in the atmosphere into a "photo- chemical" pollutant of oxidising nature. In addition, diesel engines, when misused or badly adjusted, are capable of emitting black smoke and malodorous fumes.(Park,1994). Specific health effects of various pollutants is attached is Appendix B.

Air Pollution can be grouped into two classifications (Lipfert, 1994).

1. Criteria Pollutants and
2. Hazardous air Pollutants (toxics).

Criteria pollutants are those substances deemed to present a general risk to public health and for which National Ambient Air Quality Standards (NAAQS) have been issued. A criteria document is intended to lay out the scientific basis for the derivation of standards for a specific air pollutant, including it's properties, typical ambient concentrations, and it's adverse effects on human health and welfare.

Hazardous air pollutants (toxic) are those substances identified with cancer, birth defects and neurotoxicity and for which ambient standards are neither appropriate nor practical.

In general, criteria pollutants are virtually ubiquitous in urban atmospheres (hence the name, "community air pollution"), whereas most hazardous species tend to be identified with industrial atmospheres and the workplace. Here the paper is concerned only with community air (mainly criteria pollutant), which includes-

2.9.1. Sulphur Dioxide (SO2)

This gas is a major contaminant in many urban and industrial areas. It is produced by the burning of coal and fuel oil. It's concentration is estimated in all air pollution surveys (Park,1994).

Sulphur Dioxide is a respiratory irritant that can cause impaired breathing in experimental animals and men. Because it is a soluble gas, SO2 is removed in the mouth and pharynx and primarily affects the upper respiratory tract. However, SO2 can also attach to particle surfaces and may form acidic coatings. In such cases, the loci of response will follow those of the inhaled particles (Lipfert,1994).

The major source of Sulphur Dioxide in air is man made; from the burning of high sulphur content fuels (coal, oil) in industrial furnaces and power plants (for energy generation) and in motor vehicle combustion (primarily diesel powered). SO2 in the presence of certain metal catalysts and cold moist air forms sulphuric acid and converts to ammonium sulphate. Fine paticulates are highly correlated with sulphate concentrations. Under certain weather conditions, paticulates and sulphur dioxide give rise to industrial or winter-type smogs (Headly and Lam,)

2.9.2. Nitrogen Dioxide (NO2)

These are potential hazards if allowed to reach high levels (Park,1994)

Nitrogen Dioxide has been shown to cause pulmonary disease in experimental animals. It is also thought to increase susceptibility to respiratory infections and lower respiratory tract illness (Hasselblad et al, 1992)- (Lipfert,1994).

The major sources of Nitrogen Dioxides are natural and include bacterial and volcanic action and lightning. However, urban pollution arises from man made emissions from the combustions of fossil fuels in power plants, gas fuel appliances (such as domestic cookers and heaters, oil stoves) and motor vehicles, primarily diesel powered ones. Vehicles will usually be responsible for most urban nitrogen oxides and for 75 % of nitrogen dioxide levels with diesel vehicles producing 82 % of this (Headley and Lam).

2.9.3. Suspended Particulate Matter (SPM, PM 10)

Such as dust and soot from domestic heating and industry is another useful indicator of air pollution. It is more useful than settled dust or fallout. The results are epressed as mg or μg of suspended particulate matter per cubic meter of air (Park, 1994).

The sizes of inhaled particles determines where they may deposit in the respiratory system; since smaller particles can penetrate deeper into the lung, the basis of the primary standard was changed from Total Suspended Particles(sizes upto 50 μm) to inhaled particles (PM 10) , 50 % of which are 10 μm or less. Airborne particles vary widely in composition and toxicity and can include organic matter, carbon mineral dusts, metal oxides and soluble compounds such as sulphate and nitrate salts. Particles

may also act as carriers for obsorbed gases such as SO2. Inhaled particles can affect respiratory mechanics and cause irritation and edema. Although the normal respiratory defence mechanisms act to clear foreign matter from the lungs, The half time to clear acute exposures is a matter of several days (American Petroleum Institute,1969). Friedlander (1977), presents basic data on the properties of aerosols and the distinctions between dusts (particles formed by disintegration of solids), mists (liquid particles), and smoke (solid particles formed by condensation of gases). Particles formed in the atmosphere are referred to as "secondary" (Lipfert,1994).

2.9.4. Carbon Monoxide (CO)

This gas may account for as much as 11% of motor vehicle exhaust. (Park,1994)

CO has a chemical affinity for hemoglobin and displaces oxygen (O2) in blood; it thus reduces O2 delivery to compromised tissue and can augment angina (chest pain). High concentrations (>1000 ppm) and long exposures (>8 hours) can be fatal; chronic exposure to low concentrations may accelerate atherosclerosis or precipitate coronary vessel spasm. CO poisoning can also cause gastrointestinal symptoms (Mitchell et. al.,1974); (Lipfert,1994).

CO is produced from the incomplete combution of carbon containing materials and in some industrial and biological processes. Total emissions of CO to the atmosphere equal or exceed those of all other pollutants combined. Petrol fuelled vehicles are a major source of CO. Indoor CO sources included unvented combustion appliances, such as water heaters and gas fires (Lipfert, 1994).

2.9.5. Lead,(Pb)

This is added to motor fuel to prevent knocking and can accumulate in the body, thereby adding to the body burden of lead ingested in food and water. The WHO (1969) publication "measurement of air pollutants" has described approved methods for determining the concentration of common air pollutants (Park,1994).

Lead affects the central nervous system, specially in young children. The primary source of atmospheric lead in urban areas was formerly leaded gasoline, which was effectively been phased out of the marketplace. The current concern is with indoor particles containing lead from flaking paint. Since airborne lead is no longer a problem (Lipfert, 1994). In case of Kathmandu valley, there is using leaded petrol to the motor vehicles. So the lead pollutant has been more serious in the Kathmandu valley of Nepal.

2.10. Organizational Provision and Required Policies for Environmental Protection in Nepal

> According to the national constitution:
> "The state shall give priority to the protection of the environment and also to the prevention of it's further damage due to physical development activities by increasing the awareness of the general public about environmental cleanliness, and the state shall also make arrangements for the special protection of the rare wildlife, the forests and the vegetations."
> (The Constitution of the Kingdom of Nepal, 1990 part 4, article 26, clause no. 4.)

In the top policy level, there has been set up the following organizations;

2.10.1. Environmental Protection Council,

Chaired by the Prime Minister a high level council is organised in the National Planning Commission to protect the environment. The council directs to formulate adequate policy in national level.

2.10.2. Ministry of Population and Environment

By considering the necessity and importance of environment, Nepal has set up a separate ministry in July 1995.

2.10.3. Parliamentary committees.

Under parliament, there has been setup 7 specialised committee. Except the committee for the protection of Environment, there are other committees for Finance, Human rights, Public Account, Natural Resources, Foreign Relations and Populations.

2.10.4. Activities

National Environment Impact Assessment Directory has been published and applied the guidelines on Road, Industry and Irrigation sector's development activities.

Vehicle emission test has been started and the acceptable level of emission is determined. The job of testing vehicles is now operated by Zonal Transport Management Offices and Traffic Police Offices.

2.10.5. Required policies for environmental (vehicle emission) protection in Nepal

The emission standard remains at 3 % carbon monoxide (CO) in petrol run vehicles and 65 HSU in diesel run vehicles. Till now the lead contain vehicle emission standard is not determined. However, the number of leaded fuel used by vehicles and the quality of fuel (87 octane which consists 0.58 gm./lit of lead) shows the serious problem of lead in Kathmandu valley of Nepal. To reduce the lead exposure of vehicle emission, following policies might be effective.

To determine the lead exposure level, the measurement of bleed lead is more effective methods. If the blood lead level to the childrens found more than 20mg/dl, then the micro level (nutritional and educational) intervensions will not be effective. So in this case, the macro (policy) level intervensions is required. The following steps should be taken for policy level intervensions.

Maintenance of Regular Monitoring for Ambient Air Quality Measurement,

Air is polluted by dust particulate matter, lead, NO2, SO2 and CO. These all pollutants, in any level are harmful to health. The quality of air depends on the presence of these pollutants. WHO has established the acceptance level of these pollutants which are mentioned in table 2.7. His Majesty's Government of Nepal has fixed the motor vehicle emission standard for petrol vehicle CO is 3 % and for diesel vehicle NO2 is 65HSU, but measurement of ambient air quality activities is not started yet. According to report of Nepal Environmental Scientific Services (P) Ltd. (NESS), one of the private research company, the PM 10 dust particulate is existed 2-6 times higher than

normally acceted level 70mg annual set by WHO. To measure the ambient air quality they had used their own mechines.

Hence, the HMG has also to be manage such machine to continuing measurement of ambient air. After measuring the quality of ambient air, the government could have to apply adequate programmes according to needs and resources.

Establishment of Policy and Planning Process for Ambient Air Quality Control Strategy.

With applying the programs and activities, the measurement of Ambient Air Quality needs to be operate regularly. If the remaining air quality meets the standard then the future air quality will be predicted and future emission control activities will be enforced as needed. If the present air quality does not meet the standard then needed reduction of emission should have to be computed and enforced to reduction measures.

Application of Effective Financial Policy

Application of policies and programmes to control the level of air pollution is to be continuous process because within a day or overnight even within a year we could not achieve this objective. It is a product of multiple human activities and for the sollution it requires various actions.

By the application of effective financial policy, the government could reduce the level of air pollution. One of the main pollutant in Kathmandu valley is lead (pb) used

leaded fuel by motor vehicles. To lowering the lead level in air the government have to increase tax on leaded fuel and tax free for the use of unleaded fuel. USA had started to promote the use of lead free gasoline since 1970. After about 25 years, they could completely remove the leaded gasoline from the road. Removal of leaded fuel used in motor vehicles is not easy job in developing countries like ours but it must be and we must have to start right now to save the future generation. It is also obvious that we could not create completely pollution free society, but we must have to take action as possible as we could.

The government could reduce the air pollution level by encouraging public transport services and discouraging private motor vehicles. By increasing custom and tax to the private vehicles and reducing custom and tax to the public transport vehicles, the number of total vehicles could be reduced from the road.

Improve the Condition of Road

The existing length of city road in Kathmandu valley is 394 km. Among them, only 255 km. road is black topped and rest of the roads are gravelled and earthern. The poor condition of road has increases the dust particulate by resuspense. The responsibility to upgrade the condition of road lies upon Depatment of Road. The city roads are more busy than others, where large number of vehicles runs fluently. So the DOR should have to more conscious about the city road. In alternate, the concerned municipality could also take action to upgrade the condition of road by the assistance

of DOR. In case of the city road, the Department of Health Services also have to be conscious and to cooperate to DOR.

Removal of Most Polluted Vehicles,

Tempos are proved as a most polluted vehicles in Kathmandu valley of Nepal. Because of it's inefficient engine, the government has stopped to register such vehicle since 1991. Most of these vehicles are failed at emission test, but they are running till now. Besides it 80 % of other types of vehicles were also failed at emission test. The passed vehicles gets the green sticker and it is valid for 1 Year. The validity of sticker to passanger vehicle and tourists vehicles are 6 months. Lack of seriousness about the maintenance of vehicles, repaired at a cheap price or just for formality of maintenance results to emit more emission wihin a short period. Now, we cannot remove all vehicles that are failed in ission test. So actions taken by phasewise removal (yearly 10 %) of top to low polluted vehicles might be adequate.

2.10.6 Alternative Sollution

Necesssities of public transport services is growing day by day in the urban areas of Kathmandu valley. Mainly such demands are fulfilled by diesel and petrol engine based vehicles. The increasing trend of import and use of such fuels effects adversely to the balance of trade as well as environmental condition of the nation. Nepal has big potentiality of hydro- electricity. Environmentally and economically it would be quite useful to the application of electric run motor vehicles. The existing trolley bus service (13 km.) between Tripureswore (Kathmandu) and Suryavinayak (Bhaktapur) is

successfully running. To substitute the imported fuel and to conserve the environment to some extent, the extension of electrict based public transport service system would be more advantageous. Besides, the new policy and strategic planning on the existing transport means could reduce the level of air pollution in Kathmandu valley, if -

: Phasewise (Yearly 10%) top polluted vehicles to low is removed from the road,

: Encourage to unleaded fuel (Lead Free) by reducing tax, i.e., price reduction,

: Encourage public transport services by reducing custom and tax; and discourage private vehicles by increasing custom and tax,

: Vehicles , out of pollution standard is penalised, if anybody runs in the road. The amount of penalty is increased every year on the basis of pollution level.

2.11. Conclusion

Hence, according to the consideration on the number of petrol vehicles and using practices of leaded fuel, the problem of lead pollutant might be higher in Kathmandu valley than other pollutants. The main consequences of lead pollutant is to impair the normal intellectual development and learning ability of children. Children are the pilar of future, so, here I would like to propose a study to determine the lead exposure level among the public school children of Kathmandu Valley and Gorakhkali municipality of Gorkha district, Nepal.

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