CHAPTER - IV
REVIEW OF LITERATURE

4.1 LITERATURE REVIEW OF AIR POLLUTION

Air pollution is defined as the presence of one or more contaminants such as dust, fume, gas, odour, smoke or vapour in quantities of characteristic features and duration, in the outer atmosphere, which interferes unreasonably with the comforts of life and prosperity of living beings. There are mainly five air pollutants, namely oxides of nitrogen (NOx), oxides of Sulphur (SOx), carbon dioxide (CO$_2$), hydrocarbons (HC) and Suspended particulate matter (SPM), which are considered as pollutant criteria by most of the pollution control agencies. Suspended particulate matter (Ravindra, 1991) refers to any matter dispersed in the air, whether solid or liquid, in which the individual particle is larger than small molecules, but smaller than 50 µ in diameter. Particles in this range may stay in the air for a few seconds to several months.

Adverse effects of air pollution on human health may be divided into two classes, i.e., acute and chronic. Acute effects manifest themselves immediately upon short-term exposure to pollutants at high concentrations, while chronic effects become evident only after continuous exposure to even low levels of air pollution over a period of time (Rao, 1992). The major air pollution in the world since 1993 have been documented by Goldsmith (1968) and Dix, (1981). Atmospheric pollutants may enter the body by a number of ways. They can cause eye and skin irritation. Certain particulate may be swallowed as a result of internal respiratory cleaning action or certain pollutants could even be ingested. But the primary mode of pollutant transfer into human body is through the respiratory system causing respiratory disorders, which may be fatal (Ruch and Held, 1975). The most obvious damage caused by air pollutants to vegetation occurs in the leaf structure. The damage caused is of several types like necrosis, chlorosis and epinasty. The dead areas on a leaf structure are referred to as necrosis. Chlorosis is the loss of chlorophyll in the leaf due to higher rate of growth on the upper surface.

The annual averages of ambient air quality data for 1994 for three pollutants, namely suspended particulate matter (SPM), sulphur dioxide (SO$_2$) and oxides of nitrogen (NOx) have been analyzed for big cities/towns in India. (Panwar et al., 1997) The findings reveal that in 77 per cent of the cities (i.e., 48 out of 62), the annual SPM level exceeded the permissible limit for residential areas (CPCB Report, 1995).
The polluted air carries lots of particulate matters over long distances proportionate to their size and density. Smaller the particle, the longer it remains airborne and carried over longer distances (Hodge et al., 1977; Pankett, 1984). High concentrations of particulate matter can reduce the visibility by adsorbing and scattering sunlight. Size and chemical composition are among the most important parameters influencing the ways in which air-borne particles interact with the environment. The penetration and deposition of the particulate in the respiratory tract is a direct function of their aerodynamic diameters.

Respirable fraction of the dust, where diameter is less than 4.7 μ, gets deposited in various parts of the lower respiratory tract, trachea, primary, secondary and terminal bronchi and alveolus. Continuous exposure to these dusts causes various respiratory diseases, apart from other toxic effects, on human health. (Dubey, 1992). The importance of larger particles, however, must not be underestimated since their actions in the upper respiratory tract may cause irritation, reflex broncho constriction, hyper secretion of mucus, and even allergic conditions. Acute increase in air pollutants lead to many health hazards, such as asthma (Dockery et al., 1989; Schwartz et al., 1993) infant mortality (Federick et al., 2000) cardio vascular disorders (Schwartz, 1997) etc.

The role of meteorology in studying and managing the air pollution has long been recognized. Because of the close relationship that exists between emission and atmospheric conditions to determine state of the atmosphere, thorough understanding of air pollution and meteorology is essential to predict the air quality. Effective dispersion of pollutants in the atmosphere depends primarily on the degree of stability of the atmosphere and on its turbulent structure. The significant meteorological aspects of air pollution studies have been reported by Calder (1952), Panofsky (1969), Drake et al. (1979), Murty Padmanabha and Gupta (1979) and Agrawal and Kulkarni (1992),

Samanta et al., (1998) analysed the air quality of Calcutta and observed that SPM, benzene soluble organic matter, SO\textsubscript{2} and NOx were found to be much above the NAAQS. The study also indicates that the concentration of these pollutants is higher than many other Indian cities.

Bandyopadhyay (1999) studied the quantitative and qualitative evaluations of air quality during 1990 and 1995 on Korba area and concluded that the air quality over these five years has improved considering the values of SPM in the ambient air.
The results of ambient air quality indicate that the air quality of the area has worsened over the same period considering monitored values of SO$_2$ and NOx.

Chandrasekhar et al., (2002) monitored SPM, SO$_2$ and NOx at 3 different locations in and around Tuticorin city for a period of one year. The air quality index was calculated to identify the nature of environmental condition. The concentration of SO$_2$ and NOx were high during winter and SPM level was high in the commercial cum residential area. The study indicated that the potential source for fluctuation of SPM, SO$_2$ and NOx in the study region.

Muthusubramanian and Jebra Rajasekhar (2002) studied the impact of bauxite mining on the quality of air in the Yercaud hills for all seasons of the year 1997. The concentration levels of sulphur dioxide, nitrogen dioxide and suspended particulate matter (SPM) were measured using a high volume sampler. It is found that at all the sites and seasons, the concentration levels of these air pollutants are within the permissible limits.

Gadgil and Jadahav (2004) measured the concentration of suspended particulate matter (SPM), nitrogen dioxide (NO$_2$) and sulphur dioxide (SO$_2$) at 13 important traffic intersections in Pune city. The statistical analysis of the sampling results indicates that there is not only high correlation between SPM and NO$_2$ but the levels of these pollutants are above the National Ambient Air Quality Standards (NAAQS) laid down by the Central Pollution Control Board (CPCB), India. The SO$_2$ concentrations are found to be well below the NAAQS.

Sastry et al., (2004) studied the air quality status for Hyderabad city. Monitoring was carried out at 11 locations during March 2003. These observations on air quality status and Air Quality Index (AQI) predict that most of the localities in Hyderabad are experiencing the air pollution stress and the trend is likely to worsen in near future if proper control measures are not implemented.

Bandyopadhyay (2010) made a study of dispersion modeling in assessing air quality of industrial projects under Indian regulatory regime.

4.2 LITERATURE REVIEW OF GROUND WATER QUALITY

Due to pollution of surface water sources, the importance of ground water has increased. The natural quality of ground water tends to be degraded by human activities. Due to rapid growth of urbanization and industrialization, much sewage
water is disposed off that generates fair chances of ground water pollution and is also deteriorating the water quality.

Although an appreciable number of reports are available on limnology of river and lake ecosystems of Orissa like, Orissa State Pollution Control Board Report (1985), Mishra (1991) and Behera (1994), etc. very few reports on ground water quality of Sambalpur-Sundargarh districts is available. However, Nanda (2000) made a study of ground water quality in and around Sambalpur district.

Problems regarding occurrence of ground water have been investigated by Radhakrishna (1971). Subha Rao (1990) and studied the quality of ground water in Visakhapatnam, Andhra Pradesh, and inferred that the increase in concentration of $\text{SO}_4$ and $\text{NO}_3$ ions content is due to rapid industrialisation and urbanization.

Benbi (1991) assessed the chemical composition of ground waters of Sangrur District. Mittal (1994) confirmed the bad quality of ground water of Patiala City. Babu (1994) studied the hydro chemical environment of ground water of Sagar Nagar, Visakhapatnam, Andhra Pradesh and inferred higher concentration of ions in bore wells than in dug wells.

Raja Sekhar, *et al.* (1994) investigated the pollution potential of septic tank effluents and their impact on ground water quality of Tirupati. The results indicate that the septic tank effluents contain carbonaceous and nitrogenous matters in addition to phosphorous and high bacterial population, which causes ground water pollution. Most changes that occurred in the ground water quality are increase in TDS, hardness, alkalinity, calcium, sodium, potassium, chloride, sulphate and bicarbonate ions.

Joshi *et al* (1995) studied nitrate contamination in ground water of 27 villages of Nagpur District in the year 1990-92. The nitrate content ranged from 1.2 to 164 mg/L in bore well and 1.3 to 150 mg/L in dug well. It was found that 40% of the samples had a concentration between 10 and 100 mg/L and 7% had a concentration exceeding 100 mg/L. It was observed that 20 out of the 30 dug well, samples and 14 out of 23 samples from hand pumps had nitrate exceeding the BIS limit of 10 mg/L. Other water quality parameters were within the permissible limit except excess fluoride in two cases.

Krishna, *et al* (1996) studied physico-chemical and bacterial parameters of bore wells of 10 villages of Reddigudem, Mandal, Krishna district of Andhra Pradesh. Water quality index calculated from II physico-chemical and 1 biological parameters
taken together varied from 70.9 - 164 indicating level of nutrient load and pollution in the bore well water.

Chandra Sekhar (1996) studied the quality of water used for irrigation and the effects of irrigation water quality on soil properties and plant growth.

Kannan and Venkatesan (1997) made a detailed analysis of fluoride contamination in drinking water in some areas of Arupukottai and Sivakasi Taluks in Kamarajar District. Study areas were classified into control area and fluorotic areas 1-3 based on the fluoride content and severity of fluorosis. In the fluorotic area 2 and 3 moderate to severe dental fluorosis with some skeletal fluorosis were found.

Dash and Sahoo (1999) studied the physico-chemical characteristics of ground water in the Himgir Block of Sundargarh District to evaluate its suitability for domestic and irrigation use and found that the quality of ground water of the area is suitable for both domestic and irrigation use.

Das et al. (1999) studied physico-chemical constituents of the water of Manipur for irrigation purpose. It was observed from the finding that waters from stream, river, spring and pond are safe for irrigation in respect of their EC and Na%. Hand pump waters in many cases are also observed to be unsuitable on the basis of their Na %.

Tripathy, et al. (2000) studied the status of ground water pollution in coal mining area and Moonidih (Dhanbad) and found that in 3 samples phenolic compounds are slightly higher than the recommended limit. The nitrate content in water varied from 13-65 mg/l and average value of pH was 7.1.

Srinivas, et al. (2000) carried out the analysis of ground water of Kothur Industrial Area, Mahboobnagar, and Andhra Pradesh, India and concluded that the ground water is polluted and not useful for drinking. They also found that Kothur Industrial Area ground water is highly polluted due to the discharge of effluent from polluting industries.

Dhembara et al. (2000) carried out the analysis of ground water of Kolhar area, District of Ahmednagar, Maharasthra, and concluded that the ground water quality is useful for drinking and irrigation purpose.

Elango et al. (2000) also reported the ground water quality of Chengalpet Region, Tamil Nadu, and found the ground water quality is useful for drinking and irrigation purpose.
Mishra and Sahoo (2003) carried out the physico-chemical analysis of ground water in and around Deogarh and concluded that the ground water quality is useful for drinking and irrigation purpose. However, fluoride concentration in and around Deogarh area is very low as compared to drinking water quality standard recommended for fluoride, which may cause problem in children unless fluoridation is done.

4.3 LITERATURE REVIEW OF SURFACE WATER QUALITY:

Man's concern for water, particularly for rivers, initiated since time immemorial because it serves as a means of transport, recreation, production of hydroelectricity, meeting the agricultural and industrial needs, human settlement and a treasure house of natural resources. River is the index of Indian culture and heritage and is also considered divine and holy. Industries develop near the riverbanks so that the river water could be used for cooling and for waste disposal.

Water has the unique property of dissolving and carrying in suspension a large variety of chemicals, for which it can easily become contaminated. Due to increased population growth and rapid industrialisation, particularly in a developing country like India, the rivers have been put under tremendous pressure beyond their assimilation capacities and have become grossly polluted. Almost every river system of India is polluted now at several points to a considerable extent (Chaudhuri, 1977). The sacred river Ganga even with high self-purification capacity is among India's most polluted rivers and, on receiving huge quantities of industrial effluents, sewage, garbage and all types of other pollutants, along its entire course in Uttar Pradesh, Bihar and West Bengal, has turned from a river to a drain (Agarwal et al., 1982). According to a report (Mahajan, 1988), almost all-major rivers of India are facing the problem of pollution. River pollution has already acquired a serious dimension in India with most of its fourteen major river systems being grossly polluted, so also the small rivers and tributaries (Trivedy, 1990). This situation has warranted extensive studies on levels of pollution, assessment of water quality and preventive measures to control the pollution in rivers of India.

Rivers play an important role in geochemical cycling of elements. With an estimated annual discharge of 37,000 KM³ water and 13.5×10⁹ tons of sediments (Milliman and Meade, 1983), they are the major means of transport from continents to oceans. Several attempts have recently been made to understand the river transport of
materials quantitatively and qualitatively, important of these are by Meybeck (1976), and Milliman and Meade (1983) estimated that nearly 30% of the transport of sediments by World rivers takes place in the Indian subcontinent. Mass transfer studies on Indian rivers have been initiated by Raymahasay (1970), Subramanian (1980), Sarin and Krishnaswami (1984) Biksham and Subramanian (1988a,b) and Ramesh and Subramanian (1988). Except for studies in the estuarine part of the Mahanadi by Ray et al. (1984), not much work has been done on the Mahanadi River basin.

Although the riverine system in Orissa has not been surveyed so extensively, still a few reports are available. The limnology, water quality and pollution load in the largest river Mahanadi in Orissa was studied by Das et al. (1986). Das and Dash (1986), Das et al. (1987), Kar et al. (1987), Choudhury (1988), Kar (1990) and Mishra et al. (1990) assessed the water quality and pollution load in river Irb, a tributary of Mahanadi along with the diurnal and seasonal variations in physico-chemical properties of water. Das et al. (1989) studied and compared the pollution load in the water of three rivers, namely, Irb at Brajrajnagar, Mahanadi at Choudwar and river Nagavalli at Rayagada due to waste water from three paper mills. The effect of mercury on Rushikulya estuary was reported by Sahu and Panda (1988) and the effect of wastewater from Chloro-alkali plant on the water quality of Rushikulya river estuary was studied by Shaw et al. (1991). Studies also have been carried out on the water quality and pollution load of river Brahmani, which is the 2nd largest river in Orissa. Behera et al. (1989) assessed the water quality of river Brahmani at Rourkela industrial complex where as Panda et al. (1989) has studied it at the Talcher industrial complex (upstream and downstream of the effluent discharge point). Besides, Panda (1990), Sahu (1991) and Panda et al. (1991 a) have studied the physico-chemical aspects and the pollution load in river Brahmani and Panda et al. (1991b) have analysed the organic components present in its water. Patel and Tiwari (1993 a) have studied the water quality of river Brahmani at Vedavyas and (1993 b) on the deterioration of water quality during the Vedavyas mela. Dasgupta Adak (2001 a,b,c) have studied the status of surface and ground water quality of Mandiakudar near Kalunga. The effect of the discharge of effluents from the Rourkela Steel Plant on the quality of water in river Brahmani at Rourkela was investigated by Nanda and Tiwari (1999). The samples were collected from the upstream and downstream of the discharge point and were analyzed. The results have indicated that the quality of water
deteriorates significantly after the discharge of industrial effluents into the river. Bhuvaneswaran, et al. (1998) studied the water quality of river Adyar in Chennai city. The result indicates that the river is highly polluted at certain stations. This is an undesirable factor, as the pollution is likely to affect the ground water. Negi et al. (1988) studied the nutrient status of the river Alaknanda (Garhwal, Himalaya) and reported that the lower concentration of nutrients throughout the year shows oligotrophic nature of the river. Ingole, et al. (1990) studied the water quality of river Amba and reported that the quality of water is deteriorated by the domestic sewage and industrial effluents.

Konhauser et al. (1997) studied the geochemical analysis of surface water from rivers flowing through Orissa state and concluded that the trace element concentrations were extremely variable and consistently higher than world river average. They were studied three major rivers of Orissa i.e. Brahmami, Baitarani and Mahanadi river. The Brahmami River was the most solute rich river, followed by the Baitaranâ and Mahanadi rivers. Although all the three rivers drain similar geology, the Brahmami river catchments is heavily industrialized, and water samples collected from upstream and downstream from industries indicated that anthropogenic activity directly influenced its chemical composition. Samples collected from several towns, in all three-river systems, did not invariably show similar patterns, with various elements having higher dissolved concentrations upstream. Because the concentration of total solids increased downstream, this implied that some components of the sewage had effectively sequestered available elements from solution & converted them to particulate material. Although the impact of pollution is clearly recognizable in water samples collected in proximity to the anthropogenic source, there are only slight elemental accumulations in the lower reaches of the Mahanadi River, with no accumulation in the Brahmami River. Apparently for these large rivers, discharged effluents become rapidly diluted while complexation and sedimentation further removes trace elements from the water column.

Subramanian (1979) studied and evaluated over the period of two years, the chemical quality of the Ganges, Indus, Brahmaputra, Narmada, Tapti, Mahanadi, Godavari, Krishna, Tungabhadra and Cauvery rivers. The discharge-weighted composition for Indian rivers has been calculated and compared to the world average river water. The Indian rivers are alkaline and about 25% more concentrated in dissolved salts than the world average. Discharge and downstream variations in the
water chemistry for a few selected stations are briefly explained. The range of values for suspended sediments transported by the rivers is shown together with limited seasonal, discharge and downstream variations. Chemical, sediment and total load have been calculated for Indian rivers and erosion rates are compared to the data of some major rivers of the world. The chemical data of river waters have been used to predict theoretically the mineral assemblages in carbonate and silicate systems. Preliminary studies, using X-ray diffraction, have been made on the suspended sediments and the results are compared with theoretical predictions based on water chemistry by Chakarapani, and Subramanian (1993). The Mahanadi river basin extends over an area of \(1.42 \times 10^5\) km\(^2\) and discharges about \(15.74 \times 10^6\) tons of sediment to the Bay of Bengal. The geology of the basin is mostly characterised by Precambrian rocks of the Eastern Ghats, rocks associated with the Gondwana supercontinent and recent littoral deposits. Sampling was done to determine chemical erosion, physical erosion and sedimentation rate in the basin. Carbonate rock weathering is the dominant control on the chemical composition of the river water. There is a spatial and temporal variation in water and sediment flow. The chemical erosion rate for individual elements at different sites has been established. Sedimentation rate determined by the Pb210 isotope method in core samples gave rates of 5.08 to 20.39 mm per year. This high sedimentation rate is attributed to local anthropogenic activities carried out in the basin.

Chakrapani, and Subramanian (1990) studied annual, seasonal, monthly and daily variation in the water and sediment discharge in the Mahanadi River and its controlling factors are discussed in detail. The water discharge varies from 9.61 to 1809.71 m\(^3\)s\(^{-1}\) and the total suspended matter varies from 130 to 806 mgL\(^{-1}\).The smaller tributaries upstream carry higher sediment concentration. No yearly cyclic pattern in the water flow in the basin is noticed. More than 95% of the sediment discharge takes place in the monsoon, of which the discharge during July, August and September is 90% of the annual total. On certain days of the year, the sediment discharge accounts for 10-15% of the total annual load. Water discharge, rainfall, geology of the basin and the smaller tributaries upstream seem to control the bulk of the sediment discharge. The Mahanadi annually delivers 15.74 million tons of sediment to the Bay of Bengal and more than 80% of the sediment load is carried in the coarse silt fraction.
Ray S. B, et al (1984) reported the results of extensive measurements of suspended matter, major cations Na, K, Mg, Ca and dissolved Si in the waters of the Mahanadi estuary during seven sampling periods between 1977 and 1981. The particulate concentrations ranged from 0.6 to 596 mg per liter during all sampling periods with the highest concentrations occurring in the monsoon season. The mean annual suspended load from the Mahanadi is estimated to be $1.4 \times 10^{17}$ g, almost all of which is monsoon contribution. Na, K and to a large extent Mg and Ca behave conservatively in the estuary and their annual dissolved fluxes to the Bay of Bengal are: $2.6 \times 10^{15}$, $7 \times 10^{14}$, $1.3 \times 10^{15}$ and $4.2 \times 10^{15}$ g, respectively. Silicon behaves non-conservatively; there is a net removal of 11% of the total annual dissolved Si supply of $3.3 \times 10^{15}$ g to the Bay of Bengal. A major part of this removal occurs during the winter months and appears to be biological.

4.4 LITERATURE REVIEW OF SOLID WASTE

Waste production is a part of human activity since time immemorial. In recent times, it has been realized that the waste accumulation may seriously affect the stability of the biosphere. In India, the total urban population of about 300 million produces approximately 29 million tons of solid refuse annually at an average rate of 0.33 kg per capita per day (Rao J.K and Shantaram, 1993). Rourkela-Rajgangpur-Kalunga-Kumaranda-Biramitrapur complex is being a region of rapid industrial growth, but a survey of literature revealed that no significant work has been done before the present study on the aspects of solid waste of sponge iron industries.

Patel and Tiwari (1990) had ascertained the physico chemical composition of Municipal solid waste of Rourkela (India) and compared with the available data on four other Indian cities, viz, Calcutta, Delhi, Chennai and Nagpur and concluded that the refuse of Rourkela contains a much higher percentage of leaves, hay and straw. This may due to the fact that almost every home of Rourkela contains a small or large garden and this result in higher percentage of leaves and hay in the refuse.

Roy (1988) studied recycling possibility of the municipal solid waste of Rourkela and concluded that a combination of the conventional methods of recycling of municipal solid waste such as composting and those of the recent methods for recycling, namely incineration and pyrolysis for the treatment of the municipal solid waste would be the best solution.
Gopal Dayal (1994) made an investigation of sources, implications and management of solid wastes and also studies merits and demerits of various solid waste disposal techniques. He concluded with the recommendations and suggestions for a better management of solid waste.

Jeevan Rao and M. V. Shantaram (1996) studied the characteristics of soil profiles under the urban solid waste dumps in one of the landfill site at Hyderabad. They found that the pH turned to highly alkaline with EC also exhibiting substantial increase. The content of water soluble salts and exchangeable Na and K also increased enormously in the soil profile. The ESP varied from 0.27% to 70.6%. The other important soil characteristics like total organic carbon, total nitrogen content and available nutrients content, total heavy metals and DTPA extractable metals also increased substantially.

Chandra, et al. (1997) studied utilization of solid waste such as fly ash, Gold tailing, Copper tailing, Zinc tailing, Fluorspar tailing, Polish tailing and Granite Stone dust. From the study, it may be concluded that different types of siliceous and calcareous waste materials can be utilized for manufacturing calcium silicate bricks, which may also help to reduce the environmental pollution problem to a great extent. Quantitatively, about one hundred thousand tones of tailing per year can be consumed to manufacturing 40 million bricks annually.

Giri and Bhattacharya (1999) studied the environmental problems associated with the solid waste generated in Wazirpur industrial area of Delhi. From the study it was revealed that the generated solid waste was hazardous in nature and creating severe environmental problems in the industrial area.

Ahasan (1999) studied solid waste management for Mega cities such as waste minimization, material recovery, waste processing and transformation, its disposal on land, leachate control and gas collections at land fill sites.

Mondal and Biswas (1999) studied vegetable residues available from the municipal markets, which constitute potential source of bio energy, giving a yield of methane rich bio gas with energy yield of 4.2 MJ per kg of dry matter. These authors also highlight the influence of kinetic parameters on the production of biogas.

Malviya et al. (2002) worked on solid waste composting of Indor city; but the solid waste characteristic has changed due to industrialization and urbanization. Therefore, more information on characteristics of solid waste for system and management programmes, evaluating alternative equipment needs and plans,
especially with respect to the implementation of disposal resource and energy recovery option, is needed.

A study of all these reports reveals that the problem of solid wastes and their disposal exists in almost all the countries, though the menace is felt mostly in big cities of the world. Apart from their nature and unaesthetic effects in a clean society, these wastes pose a diversity of other problems including pollution of surface and ground water, health hazards, wastage of aerable and fertile land, etc. (Pickford, 1977, Dix, 1981, Wilson, 1974).

4.5 LITERATURE REVIEW OF NOISE POLLUTION

Noise pollution is not a new phenomenon, but it has grown steadily worse with time. However, with the recent advancements in this field and general awareness regarding noise pollution, it has gained importance in terms of studying the effects of noise and its control.

Effects of noise exposure on human beings are generally manifested in the form of cardiovascular and psychological disorders (Bhargava and Shukla, 1990). Many studies (Pal 1992; Babisch et al. 1993 a, b; Hessel et al. 1994) have appeared in this regard and have shown conflicting results. The increasing trend of coronary heart diseases and hypertension observed in India (Gupta et al. 1996 a, b) can probably be attributed to some extent to increasing noise levels, apart from a few other causes. The effects generally depend on the intensity and frequency of noise, the time duration of a particular exposure, the total exposure over a lifetime, age and, must importantly, the individual's susceptibility and tolerance limit. Hearing impairment – either temporary or permanent, is probably the most common and best understood physiological effect of noise. Kryter (1970) reported temporary hearing losses immediately following a light five minute rock performance. Numerous studies on other psychological effects have also been reported in the last two and half decades. There is strong evidence that loud, unpredictable and intermittent noise exposure increases catecholamines and elevates blood pressure, heart rate and skin conductance (McLean and Tamopolosky, 1977; Cohen and Weinstein, 1982). There is also evidence that noise may impair an individual's sense of control over himself/herself (Coleman, 1979), especially in the case of children who generally lack the means to abate or avoid it so as to develop behavioral manifestation of passivity or helplessness. Noise
may also mask one’s auditory warming signals and thereby cause accidents injuring him/her, or annoyance, and general fatigue (Berry and Horton, 1974).

Noise level of many major Indian cities have been reported in literature (see for example; Pancholy, 1967; Luhar & Patil 1987; Bhatnagar, 1992; Singh, 1995, Das and Ghosal, 1996; Deka, 2000; Naik and Purohit, 2001 and Pandit et al., 2001.)

Sommerhoff J. et al 2004 reported the day – evening – night level ($L_{DEN}$) annoyance of Valdivia city of Chile. From the studied it was revealed that the noise pollution in the city being widespread throughout most of its streets area, where measured noise values are similar to those commonly observed in cities that do not have mitigation programs and whose road traffic is the principal noise generation source.

Paulo Henrique Trombetta Zannin et al. (2002) were studied on environmental noise pollution in the city of Curitiba, Brazil. The equivalent sound level values ($L_{eq}$) at the interval of 2hrs were measured and tabulated for 1000 locations spread over the urban zones of the city of Curitiba. It has been found out that 93.3% out of the locations display during the day equivalent sound levels over 65 dB (A), and 40.3% out of the total number of locations measured display during the day extremely high values of equivalent sound levels over 75dB(A).

Gaja E, et al (2003) studied the sampling techniques for estimation of the annual equivalent of noise level under urban traffic condition at Valencia (Spain).