

## 10.1. Air Pollution

### 10.1.1. Introduction

**A**ir pollutant means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration that may or tend to be injurious to human beings, other living creatures, plants, property or the environment in general. Air pollution emanates from many sources, stationary sources such as factories, power plants, smelters and smaller sources such as dry cleaners and degreasing operations, mobile sources such as cars, buses, planes, trucks, and trains; anthropogenic activities and naturally occurring sources such as windblown dust and volcanic eruptions. Air pollution has been aggravated by development that typically occurs as countries become industrialised: growing cities, increasing traffic, rapid economic development and industrialisation, and higher levels of energy consumption.

In Tamil Nadu air pollution is widespread in urban areas where vehicles are the major contributors and in a few other areas with a high concentration of industries and thermal power plants. Vehicular emissions are of particular concern since these are ground level sources and thus have the maximum impact on the general population.

### 10.1.2. Driving Force

1. Industrialization and
2. Rampant increase in vehicular population
3. Indiscriminate burning of garbage and refuse

### 10.1.3. Pressure

#### 10.1.3.1. Increase in Urban Population

Urban development is a concomitant of industrialisation. The process of urbanisation has been accelerating in the State mainly due to the fact that negative rural to urban migration is created by dearth of employment avenues in rural areas. In Tamil Nadu, the urban population has increased from 0.6 to 2.7 crores in forty years between 1961-2001. This rapid increase in urban population has

resulted in unplanned urban development, increase in consumption patterns and higher demands for transport, energy, other infrastructure, thereby leading to pollution problems in many places of the State.

#### 10.1.3.2. Increase in Vehicular growth

Vehicle population in the State has been increasing over the years mainly on account of growing urbanisation, rising real per capita income and increasing share of personalized mode of transport. The number of motor vehicles has increased in the State from 46.0 lakhs in 1999-2000 to 67.5 lakhs in 2003-04. Out of these, 48 per cent are concentrated in major cities like Chennai, Coimbatore, Salem, Madurai, Thiruchirapalli and Tirunelveli. Chennai itself accounts for about 24.5 per cent of the total registered vehicles and has more registered vehicles than those in the other cities. The registered vehicular population has increased more than two folds during the year 1996-2004.

**Table 10.1 Growth of Vehicles from year 1996-2004**

Year as on 31 <sup>st</sup> March	Transport Vehicles	Non-Transport Vehicles	Total
1996	2,83,404	24,88,442	27,71,846
1997	3,09,817	28,72,002	31,81,819
1998	3,44,244	32,70,004	36,14,248
1999	3,68,922	37,01,812	40,70,734
2000	3,99,300	42,07,928	46,07,228
2001	4,21,365	47,40,717	51,62,082
2002	4,32,106	52,25,991	56,58,097
2003	4,57,448	57,51,589	62,09,037
2004	4,72,172	62,80,301	67,52,473

Source: Commissioner of Transport, Chennai-5

#### 10.3.3. Increase in Industrial Activity

As per the latest Annual Survey of Industries published by the Central Statistical Organisation, Tamil Nadu

holds a prominent position in the industrial map of India. In 2002-03 among the 15 major States, Tamil Nadu was at the top in terms of number of factories. It ranked second in providing employment and third in fixed and productive capital, gross value of output and net value added by contributing towards National Income. In terms of number of factories, the percentage share of Tamil Nadu to all India was 15.28 per cent, 11.25 per cent of employment, 9.56 per cent of gross value of output and 8.76 per cent of net value added during 2002-03<sup>1</sup>. But this status has brought with it unwanted and unanticipated consequences such as unplanned urbanisation, pollution and the risk of accidents. The Central Pollution Control Board (CPCB) has identified seventeen categories of industries (large and medium scale) as significantly polluting and the list includes highly air polluting industries such as integrated iron and steel, thermal power plants, copper/zinc/aluminium smelters, cement, oil refineries, petrochemicals, pesticides and fertiliser units.

Air borne emissions emitted from various industries are a cause of major concern. These emissions are of two forms viz., Suspended Particulate Matter (SPM) and gaseous emission of Sulphur dioxide (SO<sub>2</sub>), Nitrogen dioxide (NO<sub>2</sub>) and Carbon monoxide (CO).

Small scale industries are a special feature of State's economy and these play an important role in pollution. Tamil Nadu has over 4.20 lakh small scale units in 2001- 2002 registering an increase of 8.25 per cent over the preceding year. In 2002-2003 the number of registered SSIs increased to 4.74 lakh. In general, Indian small-scale industries lack pollution control mechanisms. While the larger industries are better organised to adopt pollution control measures, the small-scale sector is poorly equipped (both financially and technically) to handle this problem. They have a very high aggregate pollution potential.

**Table 10.2 Small Scale Industries Registered 2002-03**

Details of Industry	No. of Units	Value in Lakhs		Employment
		Investment	Production	
Food Products	40966	81932	1079212	193845
Beverages and Tobacco Products	2916	4898	149715	77150
Cotton Textiles	24933	63007	793368	189604
Wool Silk Synthetic	2866	13699	214894	45216
Jute, Hemp, Rest Products	1566	61514	140301	56167
Hosiery and Readymade Garments	126792	249496	2600400	1119061
Wood and Wood Products	20603	41183	265781	99600
Paper and Paper Products	27108	80812	431017	118335
Leather Industries	12240	49326	410040	150802
Rubber and Plastics	15978	46335	31157	88799
Chemical and Chemical Products	18676	39651	336168	262317
Non-Metallic Mineral Products	13024	31288	179731	147251
Basic Metal Products	6211	29687	169497	63737
Metal Products	22780	62644	414596	169460
Machinery Parts except Electrical	30474	69066	454063	124123
Electrical Parts	12946	68484	322355	105941
Transport Equipments	12492	46440	206118	107734
Miscellaneous Manufacturing Industries	82128	289688	1295567	346160

Source: Industries Commissioner and Director of Industries and Commerce, Chennai-5.

### 10.1.4. State of the issue

#### 10.1.4.1. Air Pollutant emission load

The National Ambient Air Quality Monitoring (NAAQM) network is operated through the respective States Pollution Control Boards, the National Environmental Engineering Research Institute (NEERI), Nagpur and also through the CPCB. The pollutants monitored are Sulphurdioxide (SO<sub>2</sub>), Nitrogen dioxide (NO<sub>2</sub>) and Suspended Particulate Matter (SPM) besides the meteorological parameters, like wind speed and direction, temperature and humidity. In addition to the three conventional parameters, NEERI monitors special parameters like Ammonia (NH<sub>3</sub>), Hydrogen Sulphide (H<sub>2</sub>S), Respirable Suspended Particulate Matter (RSPM) and Polyaromatic Hydrocarbons (PAH). In Tamil Nadu, the NAAQM is carried out in sixteen locations which encompasses Chennai, Coimbatore, Madurai, Thoothukudi and Salem.

Based on Annual Mean Concentration (microgram per cubic meter of ambient air) of SO<sub>2</sub>, NO<sub>2</sub> and SPM and the Notified Ambient Air Quality Standards, the Ambient Air Quality Status is described in terms of Low (L), Moderate (M), High (H) and Critical (C) for Industrial (I), Residential and mixed use (R) areas of Cities/Towns in the state. The

direct impact of growth in various causal factors/ pressures is the increase in the emission loads of various pollutants, which has led to deterioration of air quality. The CPCB has been monitoring Ambient Air Quality (AAQ) in Chennai and other important cities of the State.

The following are the major results of the Ambient Air Quality, 2005 for select cities/towns of Tamil Nadu.

- ❖ In Chennai, the minimum and maximum level of SPM is 92 and 204, SO<sub>2</sub> is 4.00 and 32 and NO<sub>2</sub> is 5 and 31 micrograms per cubic meter respectively.
- ❖ In Coimbatore, the minimum and maximum level of SPM is 124 and 167, SO<sub>2</sub> is 8 and 10 and NO<sub>2</sub> is 43 and 31 micrograms per cubic meter respectively.
- ❖ In Thoothukudi, the minimum and maximum level of SPM is 68 and 70, SO<sub>2</sub> is 15 and 19 and NO<sub>2</sub> is 11 and 16 micrograms per cubic meter respectively.
- ❖ In Madurai, the minimum and maximum level of SPM is 135 and 274, SO<sub>2</sub> is 8 and 13 and NO<sub>2</sub> is 23 and 26 micrograms per cubic meter respectively.
- ❖ In Salem, the minimum and maximum level of SPM is 78 and 122, SO<sub>2</sub> is 6 and 7 and NO<sub>2</sub> is 25 and 32 micrograms per cubic meter respectively.

**Table 10.3 Summary of SO<sub>2</sub> levels in Tamil Nadu during 2004.**

City	Location	Type of Area	Average (mg/m <sup>3</sup> )	Std. deviation	n	Air Quality
Chennai	Thiruvottriyur Municipal Office	I	6	3	94	L
	Madras Medical College	R	5	3	94	L
	NEERI CSIR Campus	R	4	2	95	L
	Kathhivakkam	I	19	7	102	L
	Manali	I	20	7	95	L
	Thiruvottriyur	I	19	6	101	L

City	Location	Type of Area	Average (mg/m <sup>3</sup> )	Std. deviation	n	Air Quality
Coimbatore	SIDCO Office	I	10	3	85	L
	Dist. Collectors Office	R	8	2	73	L
	Poniarajapuram	R	8	2	87	L
Madurai	Fenner (I) Ltd.	I	19	8	93	L
	Highway	R	10	3	96	L
	Kunnathur Chatram	R	10	3	100	L
Tuticorin	Raja Agencies	I	23	7	99	L
	Fisheries College	R	20	7	98	L
	AVM Jewellery Building	R	20	5	96	L
Salem	Sowdeswari College Building	R	7	1	144	L

Source: CPCB, AAQ Data 2004.

Note:- R - Residential and other areas, I - Industrial area, Std deviation - Standard deviation,

n - number of days monitored for 16 and more hours a day

L - Low, M- Moderate, H - High and C - Critical levels of pollution based on exceedence factor

**Table 10.4 Summary of NO<sub>2</sub> levels in Tamil Nadu during 2004.**

City	Location	Type of Area	Average (mg/m <sup>3</sup> )	Std. deviation	n	Air Quality
Chennai	Thiruvottriyur Municipal Office	I	7	4	94	L
	Madras Medical College	R	7	4	94	L
	NEERI CSIR Campus	R	5	2	95	L
	Kathhivakkam	I	32	11	102	L
	Manali	I	35	13	95	L
	Thiruvottriyur	I	34	11	101	L
Coimbatore	SIDCO Office	I	51	11	85	M
	Dist. Collectors Office	R	45	8	73	M
	Poniarajapuram	R	43	10	87	M

City	Location	Type of Area	Average (mg/m <sup>3</sup> )	Std. deviation	n	Air Quality
Madurai	Fenner (I) Ltd.	I	25	11	93	L
	Highway	R	20	9	96	L
	Kunnathur Chatram	R	24	11	100	L
Tuticorin	Raja Agencies	I	19	15	99	L
	Fisheries College	R	18	12	98	L
	AVM Jewellery Building	R	18	11	96	L
Salem	Sowdeswari College Building	R	35	14	144	M

Source: CPCB, AAQ Data 2004.

Note:- R - Residential and other areas, I - Industrial area, Std deviation - Standard deviation,

n - number of days monitored for 16 and more hours a day

L - Low, M - Moderate, H - High and C - Critical levels of pollution based on exceedance factor

**Table 10.5 Summary of RSPM levels in Tamil Nadu during 2004.**

City	Location	Type of Area	Average (mg/m <sup>3</sup> )	Std. deviation	n	Air Quality
Chennai	Thiruvottriyur Municipal Office	I	39	21	93	L
	Madras Medical College	R	39	15	93	M
	NEERI CSIR Campus	R	22	11	92	L
	Kathhivakkam	I	77	23	102	M
	Manali	I	99	28	97	M
	Thiruvottriyur	I	86	31	101	M
Coimbatore	SIDCO Office	I	78	26	82	M
	Dist. Collectors Office	R	69	66	73	H
	Poniarajapuram	R	56	43	84	M
Madurai	Fenner (I) Ltd.	I	52	18	93	L
	Highway	R	50	30	96	M
	Kunnathur Chatram	R	180	80	99	C
Tuticorin	Raja Agencies	I	37	16	96	L
	Fisheries College	R	37	16	95	M
	AVM Jewellery Building	R	44	21	97	M
Salem	Sowdeswari College Building	R	36	13	143	M

Source: CPCB, AAQ Data 2004.

Note:- R - Residential and other areas, I - Industrial area, Std deviation - Standard deviation,

n - number of days monitored for 16 and more hours a day

L - Low, M- Moderate, H - High and C - Critical levels of pollution based on exceedence factor

**Table 10.6 Summary of SPM levels in Tamil Nadu during 2004**

City	Location	Type of Area	Average (mg/m <sup>3</sup> )	Std. deviation	n	Air Quality
Chennai	Thiruvottriyur Municipal Office	I	163	66	92	L
	Madras Medical College	R	103	29	93	M
	NEERI CSIR Campus	R	89	33	92	M
	Kathhivakkam	I	134	49	102	L
	Manali	I	192	55	97	M
	Thiruvottriyur	I	136	52	101	L
Coimbatore	SIDCO Office	I	167	77	82	L
	Dist. Collectors Office	R	147	86	72	H
	Poniarajapuram	R	124	76	87	M
Madurai	Fenner (I) Ltd.	I	144	56	93	L
	Highway	R	110	57	96	M
	Kunnathur Chatram	R	397	147	99	C
Tuticorin	Raja Agencies	I	55	27	96	L
	Fisheries College	R	56	23	95	L
	AVM Jewellery Building	R	65	46	97	L
Salem	Sowdeswari College Building	R	70	29	143	M

Source: CPCB, AAQ Data 2004.

Note:- R Residential and other areas, I - Industrial area, Std deviation - Standard deviation,

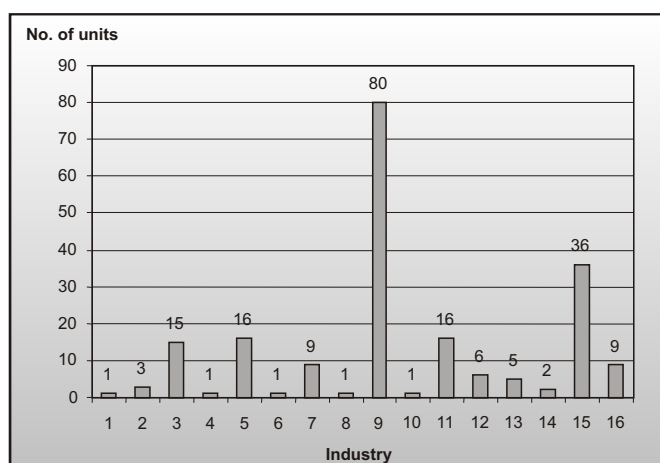
n number of days monitored for 16 and more hours a day

L- Low, M - Moderate, H - High and C - Critical levels of pollution based on exceedence factor

### 10.1.4.2. Industrial Sector

A national survey of the industrial sector states that the total estimated emissions of SPM from the 7 critical industries (Iron and steel, Cement, Sugar, Fertilisers, Paper and paper board, Copper and Aluminium) increased from 2 lakh tonnes in 1947 to 30 lakh tonnes in 1997. Of these seven critical industries, Tamil Nadu has a significant presence in cement, sugar and fertilizer industries.

Many studies have revealed that pollution is concentrated in a few industrial sub-sectors and that a sector's contribution to pollution is often disproportionate to its contribution to the industrial output. For example, petroleum refineries, textiles, pulp and paper, and industrial chemicals produce 27 per cent of the industrial output but contribute 87 per cent of sulphur emissions and 70 per cent of nitrogen emissions. Likewise, iron and steel, and non-metallic mineral products, produce about 16 per cent of the industrial output but account for 55 per cent of the particulate emissions.



1-Aluminium, 2-Caustic soda, 3-Cement, 4-Copper, 5-Distillery, 6-Dyeing, 7-Fertilisers, 8-Iron&Steel, 9-Leather, 10-Pesticides, 11-Pharma, 12-Petrochemicals, 13-Paper, 14-Refinery, 15-Sugar, 16-TTP, 17-Zinc  
Source: TNPCB, Chennai 32.

**Fig 10.1 Categories of industries in Tamil Nadu**

In Tamil Nadu, Chennai - Manali, Cuddalore, Vanniyambadi, Thoothukudi and Tirupur, are well known for petrochemical, pharmaceutical, leather and textile

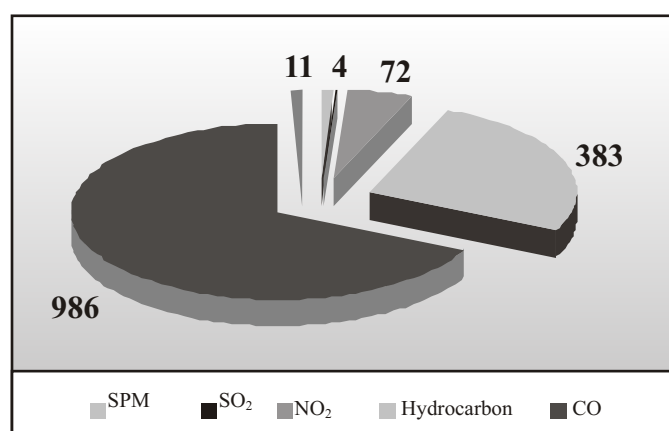
processing industries and the AAQ of these belts is considerably contaminated (figure 10.1).

### 10.1.4.3. Vehicular emissions

The density of motor vehicles per sq.km has increased from 22 in 1996 to 52 in 2004. This has led to traffic congestion and release of many toxic air pollutants into the atmosphere. Particularly, the growth of two wheelers is increasing in a steep manner, contributing to about 50.6 per cent of the pollution load. Poor maintenance of vehicles results in the spewing out of noxious fumes into the atmosphere. Roughly 400 tonnes of smoke units are being discharged into the atmosphere every day by the vehicles in Chennai. Adulterated fuel adds another dimension to the problem of pollution.

Apart from the concentration of vehicles in urban areas, other reasons for increasing vehicular pollution are the types of engines used, age of vehicles, congested traffic, poor road conditions, and outdated automotive technologies and traffic management systems. Vehicles are a major source of pollutants in major cities.

The quantum of vehicular pollutants emitted is highest in Chennai followed by Coimbatore, Salem, Madurai, Trichy and Tirunelveli. Carbon monoxide (CO) and Hydrocarbons (HC) account for 64 per cent and 23 per cent, respectively, of the total emission load due to vehicles.



Source: Report on Status of Environment in Tamil Nadu, TNPCB, Chennai 32.

**Fig 10.2 Pollution load in tonnes/day from vehicles in Chennai**

### 10.1.4.4. Vehicle air emission monitoring

Urbanisation and industrialisation have resulted in increased vehicular traffic in cities, resulting in increase in automobile emissions and toxic smoke emissions. The Board is carrying out the vehicle emission monitoring since 1992 for testing the emissions from goods transport vehicles in Chennai city in 3 locations at Alandur, Ambattur and Vyasarpadi. In addition, 236 private agencies have been authorised by the Transport Department in Chennai city to check the emission level of the vehicles. Further, the Board has established vehicle emission monitoring stations at Dindigul, Palani, Udthagamandalam (2 stations), and Chengalpattu. The Board has upgraded and computerised all its vehicle emission monitoring stations for testing diesel driven vehicles and computerisation is under process for petrol driven vehicles.

### 10.1.5. Response

#### 10.1.5.1. Air Pollution Control

The Air (Prevention and Control of Pollution) Act, 1981 as amended in 1987 aims to prevent and control air pollution and preserve the air quality. As per the provisions of the Act, the State of Tamil Nadu is declared as an 'Air Pollution Control Area'. The Board monitors industrial emissions through regular inspections of the air pollution control measures provided by the industries. Ambient air quality survey / stack emission survey are conducted to assess the quality of the emissions let out. In 2003-04, Ambient Air Quality surveys are conducted in 687 industries. The Board has granted 584 consent orders for establishment of industries and 925 consent orders to operate under the Air Act during the year 2003-2004<sup>1</sup>.

#### 10.1.5.2. Air Quality Monitoring

Air quality is being monitored by the Board to assess the concentration of air pollutants arising out of emissions from industries as well as increasing vehicular population. In

Chennai alone, ambient air quality is being monitored at three locations under National Air Quality Monitoring Programme (NAMP) and at five locations under Chennai Ambient Air Quality Monitoring Programme (CAAQM). Apart from Chennai, monitoring of ambient air quality is carried out at Thoothukudi, Coimbatore, Madurai, Salem and Tiruchirapalli. Besides, six continuous ambient air quality monitoring stations are established at Cuddalore, Tuticorin, Ranipet, Manali-Chennai, Royapuram-Chennai, Kottivakkam-Chennai to evaluate the levels of pollution<sup>1</sup>.

#### 10.1.5.3. Vehicular Emission Monitoring

There has been a rapid increase in the number of vehicles, as a result of urbanization, economic growth and easy availability of finance. Apart from new vehicles, old vehicles also exist often with outdated technology and non-observance of emission norms. The quality of fuel supplied has also compounded the problem of vehicular pollution. In this regard, high octane and unleaded fuels are to be used by the vehicle owners. The European Union emission norms are a bench mark to measure and regulate vehicular pollution. The Board is monitoring vehicular emission since 1992. In Chennai city, three vehicular monitoring stations located at Alandur, Ambattur and Vyasarpadi conduct monitoring of the vehicular emission from goods and transport vehicles on a continuous basis. In addition to this, vehicular emission is being monitored at Dindigul, Palani, Ooty, Chengalpattu and Katteri. The Board tested 51398 vehicles in 2003-04. It is found that 13206 vehicles exceeded the threshold limit during the first test. After rectification of defects, 1666 vehicles did not satisfy the emission standards. In order to reduce emission from vehicles, cleaner fuels like unleaded petrol, 3 per cent benzene level, low sulphur fuel have been introduced in Chennai. Auto manufacturers are also incorporating technological changes towards this end<sup>1</sup>.



#### 10.1.5. 4. Emission standards for industries

Tamil Nadu Pollution Control Board has laid down the maximum permissible limits for different pollutants for many categories of industries that contribute to air pollution. The standards have been notified by MoEF under the Environment (Protection) Act of 1986.

Highly polluting industries have been directed to establish their own continuous air quality monitoring systems. These units have also been asked to set up continuous stack monitoring systems with computer recording arrangements so as to monitor emissions at the source itself. As per TNPCB in year 2005-06, 42 industries have already installed these air quality monitoring systems. Self monitoring by industries through these mechanisms is being encouraged.

#### 10.1.5.5. Ambient air quality monitoring

Tamil Nadu Pollution Control Board is monitoring the ambient air quality in Chennai (3 stations), Coimbatore (3 stations), Tuticorin (3 stations), Madurai (3 stations) and Salem (1 station) under the National Ambient Air Quality Monitoring Programme. Under the State Ambient Air Quality Monitoring Programme, the Board has established five ambient air quality monitoring stations in Chennai city and Tiruchirappalli. The programmes monitor the air quality in residential, commercial and sensitive zones of the cities. The results of the programme are published every week in leading newspapers. Towards preparation of the environmental management plan for Chennai city, ambient air quality surveys have been conducted at forty one stations in Chennai to identify the most sensitive locations with respect to air pollution. The major industrial complexes, especially the clusters of chemical industries, are being monitored continuously.

With this in view, the Board has established six continuous ambient air quality monitoring systems at Cuddalore, Tuticorin, Ranipet, Manali-Thiruvallur,

Royapuram-Chennai, Kathivakkam-Thiruvallur at a cost of around Rs.40.00 lakhs each to assess the level of pollutants such as SPM, Sulphur dioxide, oxides of nitrogen, carbon monoxide, ammonia, chlorine, fluorine, etc. in the ambient air and the adequacy of air pollution control measures provided by the industries. The Board instructs the concerned industrial units to improve the air pollution control measures, whenever the levels exceed the standards prescribed. During the current year, towards strengthening of air quality monitoring, the activities of establishing one automatic continuous ambient air quality monitoring centre at Koyambedu in Chennai city, setting up of new manually operated high volume samplers in Madurai, Salem, Coimbatore, Trichy and Tirunelveli at a total cost of Rs. 72.00 lakhs and providing flue gas analysers to Board's laboratories at a cost of Rs. 39.00 lakhs are under process.

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#### 10.1.5.6. Alternate Fuel

For controlling vehicular emission, cleaner fuel like unleaded petrol, petrol with 3 per cent benzene and low sulphur fuel (0.05 per cent ) have been introduced in Chennai Metropolitan Area. Passenger cars complying with Bharat stage-II norms alone are registered in Chennai since July 2001. 2T oil auto dispensing system has been provided in retail outlets. The Board is also participating in a research project with a Non-Governmental Organisation and the Civil Supplies Department to study the use of gas chromatograph to detect fuel adulteration. Action has already been taken to introduce auto liquefied petroleum gas in Chennai as it is a

cleaner fuel. Twelve auto liquefied petroleum gas dispensing stations have been commissioned at Koyambedu, Guindy, Avadi, Mogappair, Kilpauk, Ambattur, Chrompet, Waltax Road, Vyasarpadi, Royapuram, Ambattur Industrial Estate and Mount Road. Steps are being taken to popularise the use of liquefied petroleum gas for auto-rickshaws, call taxis and other private vehicles which will help in improving air quality.

TNPCB is assisting in the implementation of the action plan evolved for the improvement of air quality in Chennai city. Periodical reports on implementation of the action plan are being sent through the Environment and Forests Department, Government of Tamil Nadu to the Environment Protection and Control Authority, Delhi constituted as per the directions of the Hon'ble Supreme Court of India.

## 10.2. WATER POLLUTION

### 10.2.1. Introduction

Water is one of the most important natural resources essential for the survival of living organisms. Water as a commodity generates concern for being an exhaustible resource and also because of the environmental issues related to its degradation. Pollution of water courses may take place due to natural causes such as silt carried by run-off, organic wastes of plants and animals, minerals leaching through soils, thermal pollution and algal blooms. It may also be due to the discharge of domestic and industrial wastewaters. Toxic chemicals used for agriculture and other purposes, solid wastes, oil from garages and cleaning of vehicles, drainage from farms and manure, land surface drainage, cattle washing, watering and dipping agricultural wastes, dust fall, wastes due to recreational use, intrusion of sea water and many more such activities cause pollution of water bodies.

Amongst the aforesaid sources of contamination, the impact of untreated sewage discharge is escalating at an

exceedingly fast rate. Most of the water bodies in the State are affected due to sewage, chemicals, oil, industrial effluents and undesirable extraneous matters. The discharge of domestic sewage and industrial effluents into natural watercourses such as rivers, streams and lakes of Tamil Nadu results in physical, chemical and biological changes leading to undesirable conditions. The stress on water resources is from multiple sources and the impact can take diverse forms. The growth of urban megalopolises, increased industrial activity and dependence of the agricultural sector on chemicals and fertilisers has led to the overcharging of the carrying capacity of our water bodies to assimilate and decompose wastes.

### 10.2.2. Driving Forces

The following are considered to be the major driving forces of water pollution.

- Urbanisation
- Industrialisation

### 10.2.3. Impact

**Industrial Pollution:** There are more than 3000 industrial units in Tamil Nadu which have been classified under the highly polluting or "red" category. The total effluent generated is about 6 lakh litres per day of which more than 5 lakh litre (85 per cent) is generated by large industries. About 400 units discharge directly into rivers. Of particular concern are the tanneries which are located in Vellore, Kancheepuram, Dindigul and Erode districts. The effluents have caused serious problems in the Palar basin. Similarly, there are a large number of textile bleaching and dyeing units in Tiruppur, Erode, and Karur, which have contaminated the Noyyal, Amaravathy and other water bodies.

There are five main industrial complexes in Tamil Nadu: Manali/Ennore, Ranipet, Cuddalore, Mettur and

Tuticorin which have chemical, petro-chemical and other industries. These complexes have also become environmental hotspots. There are cement units, distilleries, sugar, sago, paper, dairying, electroplating, chemical and fertilisers (Agro chemicals), mining industries, ores/mineral processing industries and a variety of other industries which are water consuming and also generate large quantities of effluent. Some of the industries have also provided the treated effluent for irrigation with some degree of success. However, other industries, particularly a pulp plant faced serious problems when the effluent used for irrigation contaminated the surrounding wells.

### 10.2.3.1. Coastal Pollution

The major activities that are responsible for coastal pollution in Tamil Nadu are discharge and disposal of untreated domestic and industrial wastes, discharges of coolant waters, harbour activities such as dredging, cargo handling, dumping of ship wastes, spilling of cargo's chemicals and metal ores, fishing activities etc<sup>3</sup>. There are 14 major industries located in the Ennore-Manali areas. The industries at Manali and Ennore are mostly chemical based, manufacturing petro-chemicals, fertilizers, pharmaceuticals, paints etc. There are two power plants at Ennore, namely, Ennore Thermal Power Plant with a production capacity of 200 MW and North Chennai Thermal Power Plant with a production capacity of 600 MW. The fly ash continuously deposits in the sea. The industries at Ennore-Manali are using a wide variety of raw materials and discharge waste products into the air, water or land as gaseous emissions, liquid effluents and sludge, respectively. In the coastal area of Tamil Nadu 488.02 MLD of wastewater is generated and only 226 of MLD is treated.

Several chemical industries are located in the SIPCOT industrial complex at Cuddalore. Refineries, bromide extraction plant and chemical industries are located

along the coast in Thanjavur district. Manufacture of magnesium chloride solution plant is located in Ramanathapuram district. Manufacture of aluminum flouride, urea, ammonium chloride, caustic soda manufacturing factories is located in Thoothukudi district. Except **some** of the major industries, the effluents coming out of the industries are disposed off in the coastal area. In Cuddalore the major problem confronted in the town is due to the development of Cuddalore chemical complex by the SIPCOT near the coast. There are 12 major industries very close to the seacost. The treated effluent from the industrial unit is discharged on land. Another industrial complex along the coast is found near Nagapattinam. This group consists of a TNEB, Thermal Power station at Nannilam, WIMCO Bromide extraction plant at Vedaranyam, Mettur chemical Plant manufacturing Liquid Bromide, the Indian Steel Rolling Mill at Thirunindravur of Tiruvar.

### 10.2.3.2. Sewage Pollution

In Tamil Nadu out of the 151 Municipalities and 5 Corporations, only 15 Municipalities and 4 Corporations have partial under ground sewerage system. The river water is used downstream for irrigation or drinking by people/livestock, contamination of the river has increasingly become a serious problem in many of the river basins of the State. River basins like Palar, Tamiraparani, Cauvery, Noyyal, Bhavani and Amaravathy face serious pollution problems due to sewage.

### 10.2.4. Response

All the industries discharging effluents are regulated by the Tamil Nadu Pollution Control Board. They have to meet the effluent standards fixed by the Board. Industries pay a cess based on their water consumption to the Tamil Nadu Pollution Control Board. Most of the industries have constructed effluent treatment plants. In small industrial

clusters, although the units are connected to common effluent treatment plants, the level of treatment is often not satisfactory.

### 10.2.4.1. Water Pollution Control

Water pollution is being prevented and controlled by enforcing the Water Prevention and Control of Pollution Act 1974 as amended in 1988. The TNPCB categorizes the polluting industries into three, viz., Red, Orange and Green with reference to seriousness of water pollution. Under 'red' category, there are 17 industrial concerns which are prone to adverse environmental spill over. The industries which are highly polluting the atmosphere have to obtain letters of consent to establish' and 'consent to operate'. The Board had issued 4,822 letters of consent to establish industries and 22,663 letters of consent to operate under the Water Act.

### 10.2.4.2. Water Quality Monitoring

Water quality ensures health and human effectiveness. For attaining high water quality the Board is constantly watching the inland water quality through two major programmes, namely Monitoring of Indian National Aquatic Resources System and Global Environmental Monitoring System. The water quality of rivers, namely, Cauvery, Thamiraparani, Palar, Vaigai and lakes of Udhamandalam, Kodaikannal and Yercard comes under the first category whereas water quality in Cauvery basin at Mettur, Pallipalayam, Musiri and ground water monitoring at Musiri comes under the second programme<sup>1</sup>.

### 10.2.4.3. Common Effluent Treatment Plants (CETPs)

Leather industry creates emission of high incidence of pollution affecting the water quality in the neighbourhood but also tells upon the ambience. In order to arrest the effluents of waste from the leather industries, the Board has been directing the leather industry to come under the fold of

Common Effluent Treatment Plants. In addition to the leather industry, textiles, dyeing, hotels and lodges are also bound to generate adverse externality. For coping with the incidence of pollution of varying proportion, the Board has established 33 Common Effluent Plants in different places. Establishment of the Common Effluent Treatment Plant impacted on the reduction in the quantum of pollution. The Common Effluent Treatment Plant constructed in Nagalkeni near Pallavaram is showcasing the effective role of the TNPCB in abatement of water pollution.

### 10.2.4.4. River Cleaning Projects

In Tamil Nadu out of the 151 Municipalities and 5 Corporations, only 15 Municipalities and 4 Corporations have partial under ground sewerage system. Sewage schemes are under implementation in the municipal towns of Erode, Pallipalayam, Bhavani and Komarapalayam and Tiruchirappalli corporation located along river Cauvery under the National River Action Plan. The Department of Environment is in charge of coordination of River the National River conservation Plan (NRCP) and National Lake conservation Plan (NLCP). The objective of the NRCP is to improve the water quality of major rivers, through selected pollution abatement schemes. The important works being taken up under the NRCP includes interception and diversion of sewage, laying sewage lines, construction of sewage treatment plant, providing low cost sanitation, electrical crematoria, river front development and improvement of Bathing ghats. The NRCD also sanctioned a project to clean up the six Chennai city waterways including coom, Adyar and Buckingham canal by arresting 422 sewage outfalls joining these waterways.

## 10.3. References

1. Anon, 2005. Economic Appraisal 2003-04 & 2004-05, Evaluation and Applied Research Department, Govt. of Tamil Nadu.