POLLUTION DATABASE FOR TAMIL NADU

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List of Abbreviations	
Symbol	**Meaning**
ADD	Acute Diarrheal Diseases
Avg	Average
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CFCs	Chlorofluorocarbon
CPCB	Central Pollution Control Board
Cs	Cases
DBU Class-C	Designated Best Use – Class C-Drinking Water source with conventional treatment followed by disinfection as per CPCB
DBU Class-B	Designated Best Use – Class B- Outdoor Bathing as per CPCB
D.O	Dissolved Oxygen
Ds	Deaths
E.Coli	Escherichia coli
ETP	Effluent Treatment Plant
FC	Fecal coliform
MNP	Most Probable Number
Max	Maximum
Min	Minimum
NAASQ	National Ambient Air Quality Standards
NOx	Oxides of Nitrogen
O3	Ozone
RSPM	Respirable Suspended Particular Matter
TH	Total Hardness as CaCO3
TSPM	Total Suspended Particulate Matter
TSS	Total Suspended Solids
TNPCB	Tamil Nadu Pollution Control Board
TWAD	Tamil Nadu Water Supply and Drainage Board
VOC	Volatile Organic Compounds

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2.	National Air Quality Monitoring Programme
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1. Introduction

It is a necessity to build a future in which humans live in harmony with nature. In order to protect our **ecological security we need to focus our attention and to take necessary steps both locally and globally for the following objectives:**

- Ensuring conservation of the country's biodiversity, major ecosystems and critical landscapes. Minimizing consumption and promotion of sustainable and wise use of natural resources by all sectors of society
- Promoting the active involvement of rural and traditional communities in the sustainable management and conservation of natural resources.
- Working towards reduction in the sources and impacts of climate change.
- Minimizing pollution by reducing the use of toxic chemicals and ensuring improved management of toxic waste
- Enhancing active participation of all sections of society in nature conservation and environmental protection through environmental education, awareness raising and capacity building
- Ensuring that environmental principles are integrated into development planning, policy and practices.
- Promoting environmental governance through legislation, policy and advocacy.

Therefore it becomes necessary to identify the gaps in the present management of resource bases. Such intervention will be realistic only if we have a strong database on the environmental matters of the state. Therefore, it is proposed to collect data from different source, compile them to bring together a Pollution Database for the State of Tamil Nadu.

2. Water Pollution

Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater). Water pollution occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment. Water pollution affects plants and organisms living in these bodies of water. In almost all cases the effect damages individual species, populations of species, and also causes harm to the natural biological communities. Surface water and groundwater are interrelated. Surface water seeps through the soil and becomes groundwater. Conversely, groundwater can also feed surface water sources.

2.1 Sources of Water Pollution

Sources of surface water pollution are generally grouped into two categories based on their origin.

Point sources

Point source water pollution refers to contaminants that enter a waterway from a single, identifiable source, such as a pipe line or a ditch. Examples of sources in this category include discharges from a sewage treatment plant, a factory, or a city storm water drain.

Non-point sources

Non-point source pollution refers to contamination that does not originate from a single discrete source. It is often the cumulative effect of small amounts of contaminants gathered from a large area. A common example is the leaching out of nitrogen compounds and pesticides from agricultural lands. Nutrient runoff in storm water from "sheet flow" over an agricultural field or a forest are also cited as examples of Non-Point Sources of pollution.

Other contaminants

- Contaminants may include organic and inorganic substances.
- Organic water pollutants include:
- Detergents
- Disinfection by-products found in chemically disinfected drinking water, such as chloroform.
- Food processing waste, which can include oxygen-demanding substances, fats and grease.
- Insecticides and herbicides, a huge range of organ halides and other chemical compounds
- Petroleum hydrocarbons, including fuels (gasoline, diesel fuel, jet fuels, and fuel oil) and lubricants (motor oil), and fuel combustion byproducts, from storm water runoff
- Tree and bush debris from logging operations
- Volatile organic compounds (VOCs), such as industrial solvents, from improper storage.
- Chlorinated solvents, which are dense non-aqueous phase liquids (DNAPLs), may fall to the bottom of reservoirs, since they don't mix well with water and are denser.
- Polychlorinated biphenyl (PCBs)
- Trichloroethylene Perchlorate
- Various chemical compounds found in personal hygiene and cosmetic products
- Drug pollution involving pharmaceutical drugs and their metabolites

Inorganic water pollutants include:

- Acidity caused by industrial discharges (especially sulfur dioxide from power plants)
- Ammonia from food processing waste
- Chemical waste as industrial by-products
- Fertilizers containing nutrients--nitrates and phosphates—which are found in storm water runoff from agriculture, as well as commercial and residential use
- Heavy metals from motor vehicles (via urban storm water runoff) and acid mine drainage
- Silt (sediment) in runoff from construction sites, logging, slash and burn practices or land clearing sites.

Pathogens

Disease-causing microorganisms are referred to as pathogens.

A few pathogenic bacteria can cause disease. Coliform bacteria are a commonly used bacterial indicator of water pollution, although not an actual cause of disease. Other microorganisms sometimes found in surface waters which have caused human health problems include:

- *Burkholderia pseudomallei*
- *Cryptosporidium parvum*
- *Giardia lamblia*
- *Salmonella*
- *Novovirus and other viruses*
- *Parasitic worms (helminths).*

High levels of pathogens may result from inadequately treated sewage discharges into surface water bodies.

2.2 River Water Quality

Table 2.1 Water Pollution Data For Tamil Nadu-Cauvery River (Under Minars Programme) -2004-2005

S.No	Station	DBU Class	pH Range	Dissolved Oxygen mg/l	Biological Oxygen Demand mg/l	Chloride, mg/L	Sulphate, mg/L	Nitrate, mg/L	Total Hardness mg/l	Fecal Coli MPN/100ml	Total Coli MPN/100ml
1	Padrakaliamman koil	C	6.5 – 8.2	7.6	2.0	6	2	0.2	22	327	1668
2	Trichy U/S	C	8.1 – 8.3	7.7	2.0	-	-	0.07	-	290	950
3	Grand Anaicut	C	7.8 – 8.6	7.5	2.7	-	-	0.3	-	193	675
4	Sirumugai	C	6.3 – 7.9	7.6	2.0	14	4	0.2	48	458	1888
5	Bhavani	C	7.6 – 8.8	5.8	2.4	40	14	0.16	170	421	1673
6	Karunthattan kudi	---	---	No water flow							
7	Madathukulam	C	7.6 – 8.2	7.8	0.8	------	-	0.03	-	1979	6332
8	Erode	C	7 – 8.9	5.1	3.9	50	20	0.34	150	1918	6257
9	Bhavani sagar	C	7.0 – 8.4	5.9	2.1	40	10	0.2	110	180	706
10	R.N. Pudur	C	7.4 – 8.7	6.4	2.5	---	-	0.24	-	225	791
11	P. Velur	C	7.4 – 8.9	6.6	2.5	----	-	0.74	-	195	805
12	Mohannur	C	7.4 – 8.9	6.9	2.4	----	-	0.66	-	202	911
13	Trichy D/S	C	7.3 - 8.0	6.2	4.0	----	-	0.13	3640	290	760
14	Coleroon	C	7.0 – 8.9	7.4	2.0	14246	1518	0.08	4040	116	827
15	Pitchavaram	C	6.9 - 8.4	6.4	2.2	13051	1510	0.09	230	183	573
16	Thirumukkudal	C	7.9 – 8.5	7.5	2.0	60	19	0.1	180	188	635
Tolerance Limit		C	6.5 – 8.5	>4	3	600	400	50	-	2000	5000

Source : TNPCB Year Book ,(2004-2005)

Table 2.2 Water Pollution Data for Tamil Nadu Cauvery River (Under Minars Programme)-2005-2006

Sl.No	Station	DBU Class	pH Range	Dissolved Oxygen mg/l	Biological Oxygen Demand mg/l	Chloride, mg/L	Sulphate, mg/L	Nitrate, mg/L	Total Hardness mg/l	Feacal Coli MPN/100ml	Total Coli MPN/100ml
1	Pathira Kaliamman koil	C	7.0-8.7	7.9	2.1	12	5	0.19	56	213	595
2	Trichy U/S	C	7.9-8.2	8.4	<2	---	----	0.18	---	173	633
3	Grand Anaicut	C	7.8-8.3	7.5	4.1	---	-----	0.27	---	203	461
4	Sirumugai	C	6.9-7.9	7.4	2.0	12	4	0.21	56	483	1173
5	Bhavani	C	7.5-8.2	6.7	2.2	30	16	0.22	160	501	1523
6	Karunthattankudi	C	7.9-8.8	8.2	2.3	175	43	0.14	144	257	1447
7	Madathukulam	C	7.2-8.2	7.9	2.0	50	29	0.14	212	195	615
8	Erode	C	7.5-8.5	5.6	3.2	165	59	0.25	232	809	2183
9	Bhavini sagar	C	6.3-8.2	6.1	2.3	18	7	0.2	84	549	1323
10	R.N.Pudur	C	7.2-8.4	6.9	2.3	60.0	48	0.23	220	694	1843
11	P.Velur	C	7.5-9.1	7.2	2.1	75	33	0.13	212	250	663
12	Mohanur	C	7.3-9.2	7.2	2.2	81	29	0.14	156	323	786
13	Trichy D/S	C	8.1-8.3	8.4	2.0	----	---	0.17	---	215	650
14	Coleroon	C	7.2-9.0	8.1	2.0	475	81	0.08	296	266	680
15	Pitchavaram	C	7.0-8.5	5.9	2.8	1955	222	0.43	788	497	1043
16	Thirumukkudal	C	8.0-8.4	8.5	<2	---	---	0.13	---	113	260
Tolerance limit			6.5-8.5	>4	<3	600	400	50	---	2000	5000
		B	6.5-8.5	>5	<3	----	----	---	---	---	500

Source : TNPCB Year Book, (2005-2006)

Table 2.3 Water Pollution Data for Tamil Nadu Cauvery River (Under Minars Programme (2006-2007)

Sl. No	Station	DBU Class	pH Range	Dissolved Oxygen	Biological Oxygen	Chloride, mg/L	Sulphate, mg/L	Nitrate, mg/L	Total Hardness	Feacal Coli MPN/100ml	Total Coli MPN/100

				mg/l	Demand mg/l				mg/l		ml
1	Padrakaliamman koil	B	5.87-8.41	7.4	<2	18	7	0.35	44	193	476
2	Trichy U/S	B	7.59-8.3	7.6	<2	*	*	0.17	*	153	295
3	Grand Anaicut	B	7.06-8.57	7	2.8	10	46	0.19	224	156	363
4	Sirumugai	B	5.92-7.82	7.2	<2	12	2	0.22	40	195	476
5	Bhavani	B	6.43-8.11	6.5	<2	30	6	0.151	168	229	491
6	Karunthattan Kudi	B	7.49-7.99	7.4	<2	194	58	0.114	220	108	255
7	Madathukulam	B	6.98-8.63	7.4	3.0	24	20	0.328	220	125	303
8	Erode	B	6.75-7.92	4.5	6.7	53	21	0.19	164	503	1413
9	Bhavanisagar	B	6.33-7.76	5.8	2.5	24	6	0.184	64	203	498
10	R.N. Pudur	B	6.66-8.47	6.0	3.5	*	*	0.181	*	267	662
11	P. Velur	B	7.34-8.62	7.4	<2	68	28	0.132	196	174	380
12	Mohanur	B	7.02-8.46	7.7	<2	68	29	0.169	192	155	324
13	Trichy D/S	B	7.37-8.15	7.4	2.0	*	*	0.415	*	238	405
14	Coleroon	B	7.33-8.22	8.3	4.0	112	44	0.486	188	260	2701
15	Pitchavaram	B	6.74-8.33	6.1	2.8	170	47	0.129	47	223	455
16	Thirumukkudal	B	7.22-8.26	7.1	<2	87	26	0.708	188	143	433
Tolerance Limit		A	6.5-8.5	6.0	2	250	400	20	300	2	50
		B	6.5-8.5	5	3	-	-	-	-	200	500
		C	6.5-8.5	4	3	600	400	50	-	2000	5000

Source: TNPCB Year Book, (2006-2007)

Table 2.4 Water Pollution Data for Tamil Nadu Cauvery River (Under Minars Programme)-2008-2009

S.No	Station	DBU Class	pH Range	Dissolved Oxygen mg/l	Biological Oxygen Demand mg/l	Chloride mg/L	Sulphate , mg/L	Nitrate, mg/L	Total Hardness mg/l	Feacal Coli MPN/100ml	Total Coli MPN/100 ml
1	Padrakaliamman koil	C	7.29	7.84	0.81	26	15	0.274	62	275	448
2	Trichy U/S	B	7.94	7.63	0.8	135	55	0.17	160	170	285
3	Grand Anaicut	C	7.8	6.24	2.78	215	67	0.47	330	205	366
4	Sirumugai	C	7.19	7.6	0.92	16	10	0.28	40	217	378
5	Bhavani	B	7.47	6.2	0.9	41	40	0.2	144	323	551
6	Karunthattan kudi	B	7.8	7.43	1.1	202	3	0.25	270	168	313
7	Madathukulam	B	7.69	7.8	1.39	32	20	0.32	116	165	324
8	Erode	C	7.44	5.3	1.44	84	43	0.21	150	607	967
9	Bhavani sagar	C	7.3	6.7	0.86	18	8	0.22	48	248	481
10	R.N. Pudur	C	7.55	6.2	1.04	39	38	0.24	160	344	594
11	P. Velur	C	7.87	7.37	0.93	190	58	0.23	220	348	593
12	Mohannur	C	7.86	7.5	0.71	155	48	0.28	210	274	465
13	Trichy D/S	C	7.89	7.83	1.3	175	59	0.15	240	320	500
14	Coleroon	C	7.91	7.62	1.16	135	48	0.25	220	471	753
15	Pitchavaram	C	7.56	5.01	1.72	121	43	0.22	230	673	1108
16	Thirumukkudal	B	8.11	7.8	0.89	205	69	0.21	240	135	248
Tolerance Limit		B	6.5-8.5	5	3	-	-	-	-	200	500
		C	6.5-8.5	4	3	1000	400	50	600	2000	5000

Source: TNPCB Year Book (2008-2009)

Table 2.5 Water Pollution Data for Tamil Nadu Cauvery River (Under Minars Programme) 2009-2010

S.no	Name of station			Biological	Nitrate	Total	Faecal	Nitrite	Dbu

		pH	Dissolved oxygen mg/l	oxygen demand at 27°c Mg/l	Mg/l	Coliform Mpn/100ml	coliform Mpn/100ml	Mg/l	Class
1	Padrakaliamman koil	7.81	8.4	0.6	0.10	304	131	0.01	B
2	Trichy U/S	8.37	7.5	1.0	0.11	330	143	0.0	B
3	Grand Anaicut	8.22	7.9	2.2	0.19	471	235	0.37	C
4	Sirumugai	7.63	7.9	1.0	0.19	270	107	0.02	B
5	Bhavani	7.94	5.5	1.5	0.16	471	238	0.11	C
6	Karunthattankudi	8.04	10.9	0.7	0.10	325	190	0.02	B
7	Madathukulam	7.92	8.3	1.0	0.13	309	150	0.01	B
8	Erode	7.88	3.6	7.6	0.11	2215	1019	0.62	D
9	Bhavini sagar	7.68	6.8	1.1	0.15	339	153	0.1	C
10	R.N.Pudur	8.06	6.5	1.2	0.10	374	172	0.1	B
11	P.Velur	8.22	7.6	1.1	0.17	339	151	0.09	B
12	Mohanur	8.15	7.4	1.3	0.11	329	143	0.06	B
13	Trichy D/S	8.09	6.0	4.5	0.10	2568	640	0.004	C
14	Coleroon	8.15	7.2	1.3	0.14	286	119	0.07	B
15	Pitchavaram	8.00	7.2	1.5	0.11	351	178	0.03	B
16	Thirumukkudal	8.46	7.8	0.7	0.10	293	123	0.006	B
		6.5-8.5	5	3	-	500	200	-	B
*TOLERANCE LIMIT		6.5-8.5	4	3	50	5000	2000	-	C

Source: TNPCB Year Book (2009-2010)

Table 2.6 Water Pollution Data for Tamil Nadu Cauvery River – (Under Minars Programme) 2011 – 2012

S. NO	Name of stations	D.O mg/l	pH	Conductivity mhos/cm	BOD at 27 C mg/l	Nitrate mg/l	Fecal coliform MPN/100 ml	Total coliform MPN/100 ml	Turbidity NTU	Phenophthaline Alkalinity mg/L	Total Alkalinity as $CaCO_3$ mg/L	Chloride mg/L	COD mg/L	Total Kjeldahl Nitrogen mg/L	DBU Class
1	Pathira kaliamman koil	7.79	8.10	244	1	0.28	95	204	4	3	77	26	16	2	B
2	Sirumugai	7.83	8.00	179	1	0.26	93	199	4	0	60	19	17	2	B
3	Bhavani sagar	6.18	7.85	273	1	0.17	144	293	3	2	102	27	17	2	B
4	Bhavani	5.73	8.26	309	1	0.18	153	307	3	3	127	28	17	3	B
5	R.N.Pudur	6.29	8.06	488	1	0.26	157	318	3	7	169	37	17	3	B
6	Erode	6.08	7.84	430	1	0.24	168	338	5	6	172	44	18	4	B
7	P.Velur	6.87	7.95	458	1	0.19	152	298	3	6	172	47	16	3	B
8	Mohanur	6.43	7.83	486	1	0.17	158	326	3	6	173	46	16	3	B
9	Madathukulam	7.83	8.00	179	1	0.26	93	199	4	0	60	19	17	2	B
10	Thirumukkudal	6.41	8.12	562	1	0.17	154	313	3	12	202	83	27	3	B
11	Trichy U/S	7.40	8.16	533	1	0.20	131	268	4	10	185	56	17	3	B
12	Trichy D/S	6.15	8.02	716	1	0.17	188	368	4	11	234	91	17	3.3	B
13	Grand AnaIcut	6.26	8.02	734	1	0.23	176	328	4	10	246	92	19	3	B
14	Coleroon	7.37	8.14	1083	1	0.21	144	298	5	7	180	237	17	3	E
15	Pitchavaram	7.12	8.27	1034	1	0.17	148	278	6	10	182	216	16	4	E
16	Karunthattankudi	6.44	8.05	677		0.20	163	357	6	11	214	94	16	3	B
*Tolerance Limit		5	6.5-8.5		3	-	200	500	-	-	-	-	-	-	B
		-	6.5-8.5	2250	-	-	-	-	-	-	-	600	-	-	

Table 2.6 –Cont - Water Pollution Data for Tamil Nadu Cauvery River – (Under Minars Programme) 2011 – 2012

S. NO	Name of stations	Ammonia - N AS n mg/L	Hardness as $CaCO_3$ mg/L	Calcium as Ca^{++} mg/L	Magnesium as Mg^{u} mg/L	Sulphate mg/L	Sodium mg/L	Total Dissolved Solids mg/L	Total Fixed Solids mg/L	Total Suspended Solids mg/L	Phosphate mg/L	Boron mg/L	Potassium mg/L	Fluoride mg/L	DBU Class
1	Pathira kaliamman koil	0.78	73	14	9	6	28	161	143	8	<0.005	<0.002	2	0.28	B
2	Sirumugai	0.75	64	14	7	6	15	125	105	8	<0.005	<0.002	2	0.2	B
3	Bhavani sagar	0.62	93	21	9	9	21	183	167	5	<0.005	<0.002	3	0.2	B
4	Bhavani	0.87	118	26	12	8	27	208	192	8	<0.005	<0.002	3	0.26	B
5	R.N.Pudur	0.87	152	34	16	14	35	286	265	6	<0.005	<0.002	4	0.4	B
6	Erode	0.99	161	33	19	15	44	297	271	5	<0.005	<0.002	5	0.3	B
7	P.Velur	0.78	154	31	18	18	48	299	280	4	<0.005	<0.002	5	0.3	B
8	Mohanur	0.75	150	31	17	15	45	302	278	4	0.069	0.002	4	0.23	B
9	Madathukulam	0.75	64	14	7	6	15	125	105	8	<0.005	<0.002	2	0.2	B
10	Thirumukkudal	0.85	207	40	26	22	70	424	383	6	<0.005	0.002	6	0.4	B
11	Trichy U/S	0.81	168	42	19	17	61	350	633	5	0.0453	<0.002	6	0.4	B
12	Trichy D/S	1.03	243	46	31	39	81	465	436	8	0.110	<0.002	10	0.3	B
13	Grand AnaIcut	0.94	406	49	31	43	81	480	454	5	0.112	<0.002	11	0.31	B
14	Coleroon	0.87	219	35	31	30	148	664	638	8	<0.005	<0.002	13	0.4	E
15	Pitchavaram	1.08	213	35	30	30	148	634	602	10	<0.005	<0.002	14	0.4	E
16	Karunthattankudi	0.92	176	38	22	24	168	448	417	11	0.0765	<0.002	9	0.3	B
*Tolerance Limit		-	-	-	-	-		-	-	-	-	-		1.5	B
		-	-	-	-	1000		2100	-	-	-	2		-	

Source: TNPCB Year Book (2011-2012)

Table 2.7 Water Pollution Data for Tamil Nadu Tamiraparani River - (Under Minars Programme) 2004-2005

S.No	Station	DBU Class	pH Range	Dissolved Oxygen mg/l	Biological Oxygen Demand mg/l	Chloride, mg/L	Sulphate, mg/L	Nitrate, mg/L	Total Hardness mg/l	Feacal Coli MPN/100ml	Total Coli MPN/100ml
1	Cheranmadevi	B	6.7 – 7.9	7.1	1.2	30	7	0.17	13	62	223
2	Kokirakulam	B	6.6 – 7.9	6.2	2.2	25	13	0.07	22	87	385
3	Papanasam	B	6.2 – 7.9	7.3	1.2	35	28	0.13	11	52	235
4	Murappanadu	B	6.8 – 7.9	6.7	1.1	-	-	0.1	-	12	37
5	Ambasamudram	B	6.2 – 7.9	7.4	1.4	25	5	0.16	5	36	179
6	Thiruvidaimarudhur	B	6.3 – 7.8	7.1	1.8	20	7	0.18	14	11	32
7	Authoor	B	7.3 – 8.4	7.0	2.8	-	-	0.1	-	46	198
Tolerance limit			6.5 - 8.5	>5	3	-	-	-	-	-	500

Source: TNPCB Year Book (2004-2005)

Table 2.8 Water Pollution Data for Tamil Nadu Tamiraparani River -(Under Minars Programme) 2005-2006

Sl. No	Station	DBU Class	pH Range	Dissolved Oxygen mg/l	Biological Oxygen Demand mg/l	Chloride, mg/L	Sulphate, mg/L	Nitrate, mg/L	Total Hardness mg/l	Feacal Coli MPN/100 ml	Total Coli MPN/100 ml
1	Cheranmadevi	B	6.8-7.3	6.3	1.3	55	10	0.3	56	34	103
2	Kokirakulam	B	6.6-7.5	6.9	1.8	55	18	0.16	102	54	235
3	Papanasam	B	6.8-7.6	7.7	1.8	55	36	0.49	48	26	108
4	Murapanadu	B	6.6-8.4	6.1	1.3	55	26	0.16	104	10	28
5	Ambasamudram	B	6.3-7.3	7.3	1.4	40	14	0.16	40	27	1058
6	Thiruvidaimarudhur	B	6.3-7.3	7.2	1.3	35	16	0.17	54	11	26
7	Authoor	B	6.5-8.6	6.9	2.4	55	26	0.13	100	35	156
	Tolerance limit		6.5-8.5	>5	3	---	---	---	---	---	500

Source: TNPCB Year Book (2005-2006)

Table 2.9 Water Pollution Data for Tamil Nadu Tamiraparani River -(Under Minars Programme) 2006-2007

Sl No	Station	DBU CLASS	pH Range	Dissolved Oxygen mg/l	Biological Oxygen Demand mg/l	Chloride, mg/L	Sulphate, mg/L	Nitrate, mg/L	Total Hardness mg/l	Feacal Coli MPN/100ml	Total Coli MPN/100ml
1	Cheranmadevi	B	6.4-6.82	6.37	1	17	20	0.06	32	42	101
2	Kokirakulam	B	6.42-6.92	6.82	1.7	18	12	0.059	31	57	209
3	Papanasam	B	6.16-6.82	7.42	1.3	16	18	0.053	12	28	84
4	Murappanadu	B	7.12-7.44	7.78	1.49	18	8	0.099	42	16	34
5	Ambasamudram	B	6.12-6.90	7.01	1.32	14	17	0.054	19	34	91
6	Thiruvidaimarudhur	B	6.24-6.88	7.08	1.32	15	18	0.052	16	11	28
7	Authoor	B	7.06-7.36	6.69	2.41	47	12	0.097	141	35	114
TOLERANCE LIMIT		B	6.5-8.5	>5	3	-	-	-	-	200	500

Source: TNPCB Year Book (2006-2007)

Table 2.10 Water Pollution Data for Tamil Nadu Tamiraparani River -(Under Minars Programme)- 2008-2009

SI.No	Station	DBU	pH	Dissolved	Biological	Chloride,	Sulphat	Nitrate,	Total	Feacal	Total Coli

		CLASS	Range	Oxygen mg/l	Oxygen Demand mg/l	mg/L	e, mg/L	mg/L	Hardness mg/l	Coli MPN/100 ml	MPN/100 ml
1	Cheranmadevi	B	6.74	6.98	1.76	41	15	0.12	85	133	273
2	Kokirakulam	C	6.69	6.79	2.17	48	24	0.18	90	258	373
3	Papanasam	B	6.85	7.23	1.11	19	28	0.14	26	93	215
4	Murappanadu	B	6.91	6.9	1.76	70	20	0.11	150	130	230
5	Ambasamudram	B	6.78	7.37	1.1	26	6	0.12	60	92	158
6	Thiruvidaimarudhur	B	7.01	7.3	1	26	8	0.15	40	85	152
7	Authoor	C	6.98	7.41	2	77	27	0.13	220	272	466
Tolerance limit		B	6.5-8.5	5	3	-	-	-	-	200	500
		C	6.5-8.5	4	3	1000	400	50	600	2000	5000

Source: TNPCB Year Book (2008-2009)

Table 2.11 Water Pollution Data for Tamil Nadu Tamiraparani River - (Under Minars Programme) 2009-2010

Sl.no	Name of station	Ph	D.o mg/l	Bod at 27°c Mg/l	Nitrate Mg/l	Total Coliform	Faecal coliform	Nitrite Mg/l	Dbu Class

						Mpn/100ml	Mpn/100ml		
1	Papanasam	6.84	0.05	7.46	1.37	154	92	0.01	B
2	Cheranmadevi	6.89	0.08	7.44	1.47	142	80	0.034	B
3	Kokirakulam	7.01	0.10	6.91	2.53	377	258	0.05	C
4	Murapanadu	7.19	0.08	7.11	1.75	180	101	0.04	B
5	Thirupudaimarudur	6.94	0.07	7.07	1.71	168	90	0.03	B
6	Ambasamudram	6.81	0.06	7.32	1.58	153	93	0.03	B
7	Authoor	7.31	0.12	7.37	2.38	309	202	0.06	C
*Tolerance limit		6.5-8.5	5	3		500	200	-	B
		6.5-8.5	4	3	50	5000	2000	-	C

Source : TNPCB Year Book (2009-2010)

Table 2.12 Water Pollution Data for Tamil Nadu Tamiraparani River - (Under Minars Programme) 2010-2011

Sl. No	Name of station	Ph	D.o mg/l	Bod at 27c Mg/l	Nitrate Mg/l	Total Coliform	Faecal coliform	Nitrite Mg/l	Dbu Class

						Mpn/100ml	Mpn/100ml		
1	Papanasam	7.11	7.50	1.50	0.10	118	73	0.04	B
2	Cheranmadevi	7.02	7.3	1.7	0.083	168	80	0.060	B
3	Kokirakulam	7.15	6.50	2.30	0.33	348	223	0.07	C
4	Murapanadu	6.96	6.80	1.70	0.21	143	76	0.10	B
5	Thirupududaimarudur	7.13	7.10	1.50	0.41	132	73	0.04	B
6	Ambasamudram	7.02	6.70	1.40	0.23	122	71	0.03	B
7	Authoor	7.23	7.00	2.40	0.52	197	102	0.04	B
Tolerance limit		6.5-8.5	5	5	3	500	200	-	B
			50	4	3	5000	2000	-	C

Source: TNPCB Year Book (2010-2011)

Table 2.13 Water Pollution Data for Tamil Nadu Tamiraparani River – (Under Minars Programme) 2011 – 2012

S. NO	Name of stations	D.O mg/l	pH	Conductivity mhos/cm	BOD at 27 C mg/l	Nitrate mg/l	Fecal Coliform MPN/100 ml	Total coliform MPN/100 ml	Turbidity NTU	Total Alkalinity as $CaCO_3$ mg/L	Chloride mg/L	COD mg/L	DBU Class

1	Papanasam	7.33	7.65	104	1	0.07	36	93	14	39	21	23	B
2	Cheranmadevi	7.12	7.74	106	1	0.13	66	117	16	36	17	18	B
3	Kokirakulam	6.41	7.75	141	2	0.15	176	350	19	50	22	27	B
4	Murapanadu	6.84	7.45	361	2	0.13	75	160	17	70	67	22	B
5	Thiruvidaimarudur	6.98	7.43	88	1	0.10	52	112	14	27	15	14	B
6	Ambasamudram	7.00	7.53	73	1	0.08	42	92	14	26	13	15	B
7	Author	7.01	7.55	1642	3	0.14	73	159	21	174	393	36	B
8	Eral	6.93	7.22	365	2	0.13	66	130	15	113	26	20	B
9	Kallidai Kurichi	7.44	7.59	87	1	0.09	41	94	13	28	15	15	B
10	Srivaikuntam	6.80	7.02	264	1	0.13	76	151	13	80	21	23	B
11	Vellakovil	6.27	7.69	179	2	0.21	122	273	22	55	25	17	B
12	Sivalaeri	6.28	7.59	192	2	0.18	125	270	24	57	27	33	B
*Tolerance Limit		5	6.5-8.5		3	-	200	500	-	-	-	-	B

Source: TNPCB Year Book (2011-2012)

(Cont.) Table 2.13 Water Pollution Data for Tamil Nadu Tamiraparani River – (Under Minars Programme) 2011 – 2012

S.NO	Name of stations	Total Kjeldahl Nitrogen mg/L	Ammonia – N, mg/L	Hardness as $CaCO_3$ mg/L	Calcium as Ca^{++} mg/L	Magnesium as Mg^{u} mg/L	Sulphate mg/L	Sodium mg/L	Fluoride mg/L	DBU Class
1	Papanasam	3.3	3	34	7	4	8	16	0.04	B
2	Cheranmadevi	NA	1	31	8	2	8	11	<0.1	B
3	Kokirakulam	NA	3	44	12	3	9	15	<0.1	B
4	Murapanadu	NA	2	77	24	6	11	60	1.00	B
5	Thiruvidaimarudur	NA	2	23	6	2	7	8.8	<0.1	B

6	Ambasamudram	NA	2	24	6	2	7	6.5	<0.1	B
7	Author	NA	4	279	90	25	21	352	<0.1	B
8	Eral	NA	2	94	30	5	13	41	<0.1	B
9	Kallidai Kurichi	NA	2	23	6	2	7	9	<0.1	B
10	Srivaikuntam	NA	2	73	22	4	11	26	<0.1	B
11	Vellakovil	NA	2	48	15	3	10	17	<0.1	B
12	Sivalaeri	NA	2	53	16	3	11	17	<0.1	B
*Tolerance Limit		-	-	-	-	-	-	-	1.5	B

S. NO	Name of stations	Total Dissolved Solids mg/L	Total Fixed Solids mg/L	Total Suspended Solids mg/L	Phosphate mg/L	Boron mg/L	Potassium mg/L	DBU Class
1	Papanasam	78	59	14	0.02	<0.002	1.67	B
2	Cheranmadevi	58	36	15	0.04	<0.002	1.50	B
3	Kokirakulam	80	53	18	0.05	<0.002	2.00	B
4	Murapanadu	207	178	17	0.04	<0.002	4.09	B
5	Thiruvidaimarudur	49	31	13	0.02	<0.002	1.33	B
6	Ambasamudram	47	30	13	0.02	<0.002	1.33	B
7	Author	945	902	27	0.06	<0.002	16.00	B
8	Eral	206	172	16	0.03	<0.002	4.58	B
9	Kallidai Kurichi	47	30	13	0.02	<0.002	1.42	B
10	Srivaikuntam	152	121	14	0.04	<0.002	3.67	B
11	Vellakovil	102	66	20	0.05	<0.002	2.25	B
12	Sivalaeri	110	74	22	0.05	<0.002	2.33	B
*Tolerance Limit		-	-	-	-	-	-	B

Source: TNPCB Year Book (2011-2012)

Table 2.14 - Palar River Water Quality between 2003-2012

Year	Palar River			
	pH	Nitrate, mg/L	DO, mg/L	BOD @ 27 °C, mg/L
2003-2004	7.42-8.30	0.1	6.2	3
2004-2005	6.9-8.0	0.15	5.9	2
2005-2006	6.8-7.9	0.21	7	2
2006-2007	6.87-7.92	0.16	6.78	2
2008-2009	7.53	0.3	6.9	2
2009-2010	7.46	0.26	6.6	2.75
2010-2011	7.52	0.38	6.5	2.9
2011-2012	7.5	0.18	6.18	1.83

Source: TNPCB Year Book

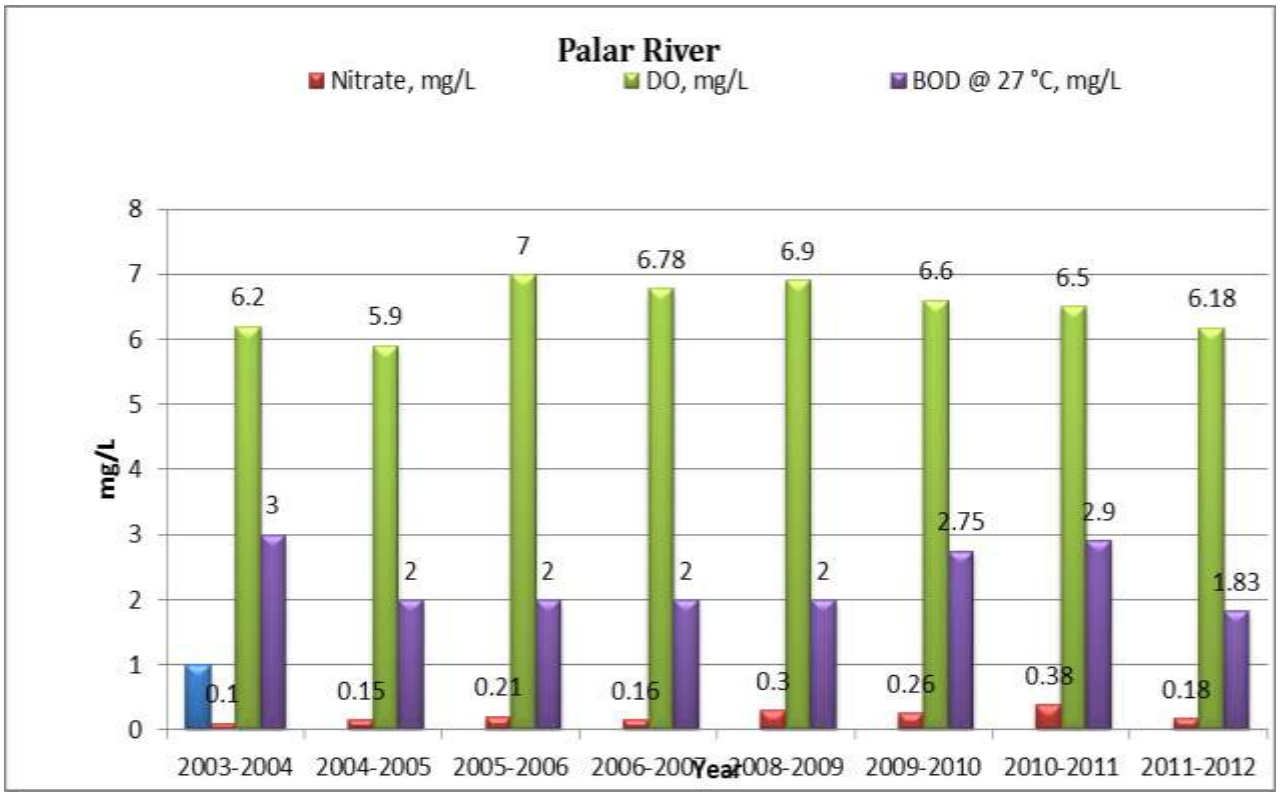


Figure. 2.1 Water quality for the river Palar (2003-2012)

Table 2.15 Vaigai River water Quality Between 2003 &2012

Year	Vaigai River			
	pH	Nitrate, mg/L	DO, mg/L	BOD @ 27 °C, mg/L
2003-2004	7.1-7.4	0.1	6.7	6
2004-2005	6.8-7.4	0.1	6.7	4.5
2005-2006	7.52-7.60	0.05	6.8	2.3
2006-2007	6.26-7.67	0.07	7.15	2.9
2008-2009	7.59	0.05	6.6	2.03
2009-2010	7.51	0.527	6.5	2.8
2010-2011	7.04	0.09	4.6	4
2011-2012	7.49	1.15	6.2	7

Source: TNPCB Year Book

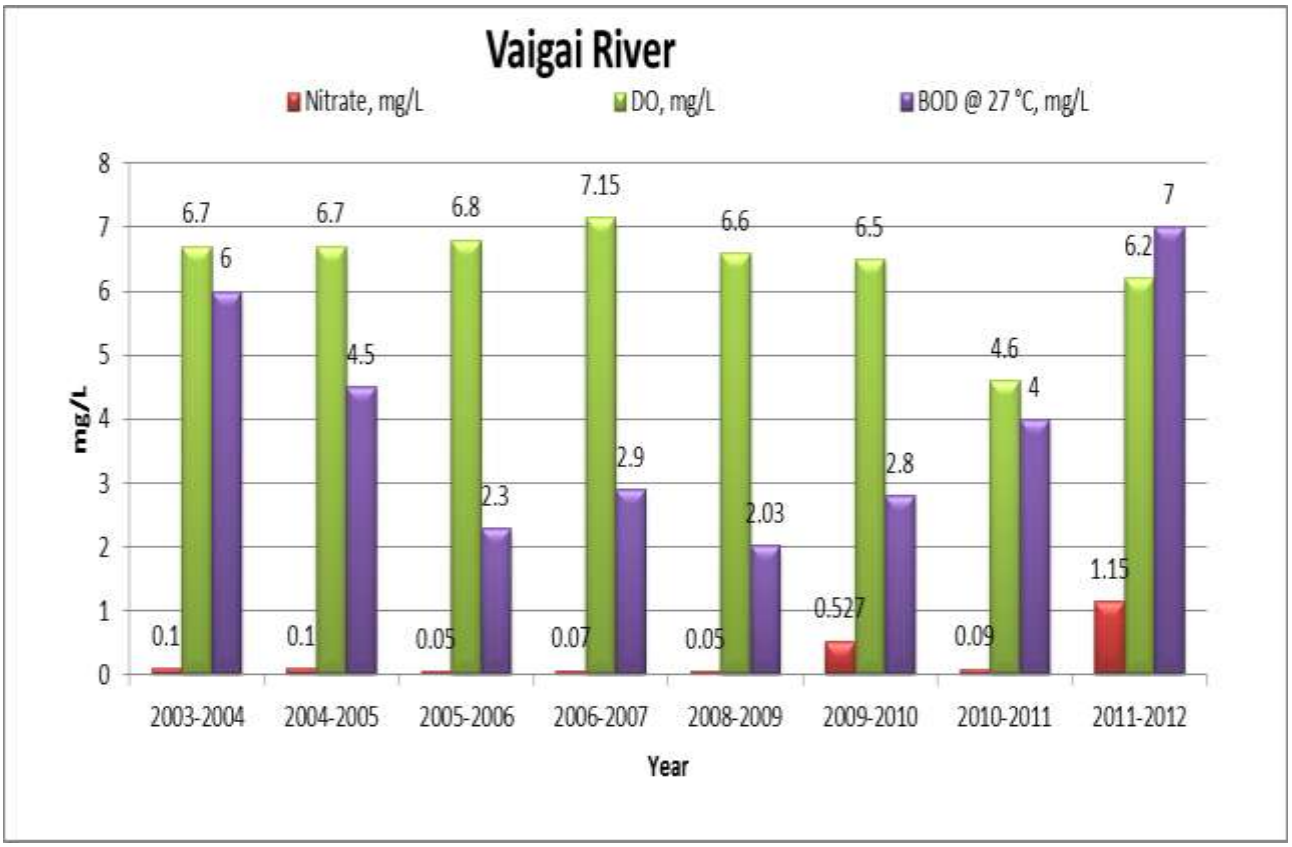


Figure. 2.2 Water quality for the river Vaigai (2003-2012)

Table 2.16 Adayar River water Quality Between 2003 &2012

Year	Adayar River		
	TSS, mg/L	COD, mg/L	BOD @ 27 °C, mg/L
2005-2006	76	167	41
2006-2007	40	148	27
2008-2009	43	126	28
2009-2010	58	154	42
2010-2011	52	91	18
2011-2012	49	101	19

Source: TNPCB Year Book

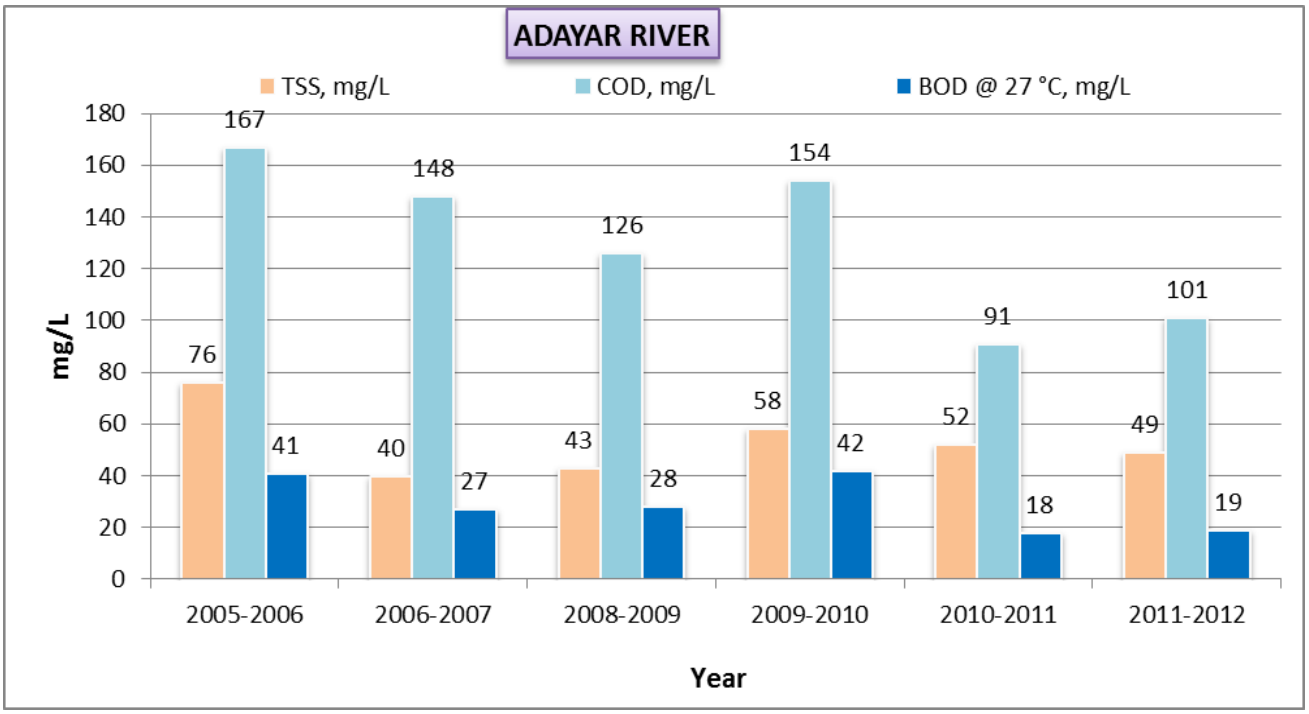


Figure. 2.3 Water quality for the Adayar River (2003-2012)

Table 2.17 Buckingham Canal Water Quality between 2003 &2012

Year	Buckingham Canal		
	TSS, mg/L	COD, mg/L	BOD @ 27 °C, mg/L
2005-2006	307	602	168
2006-2007	87	250	58
2008-2009	150	232	76
2009-2010	154	253	89
2010-2011	110	176	48
2011-2012	158	308	55

Source : TNPCB Year Book

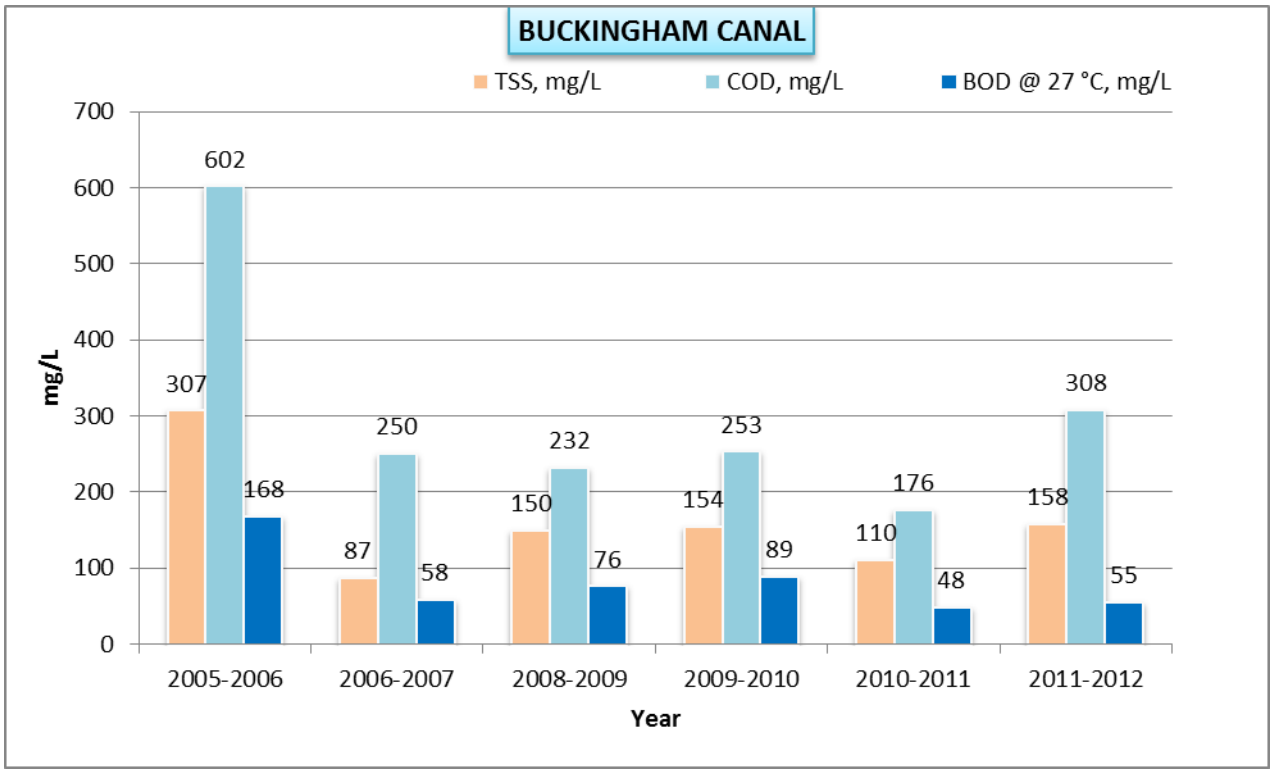


Figure. 2.4 Water quality for the Buckingham Canal (2003-2012)

Table 2.18 Cooum River Water Quality Between 2003 &2012

Year	Cooum River		
	TSS, mg/L	COD, mg/L	BOD @ 27 °C, mg/L
2005-2006	247	368	116
2006-2007	63	212	49
2008-2009	58	131	35
2009-2010	64	135	46
2010-2011	62	101	22
2011-2012	86	179	35

Source: TNPCB Year Book

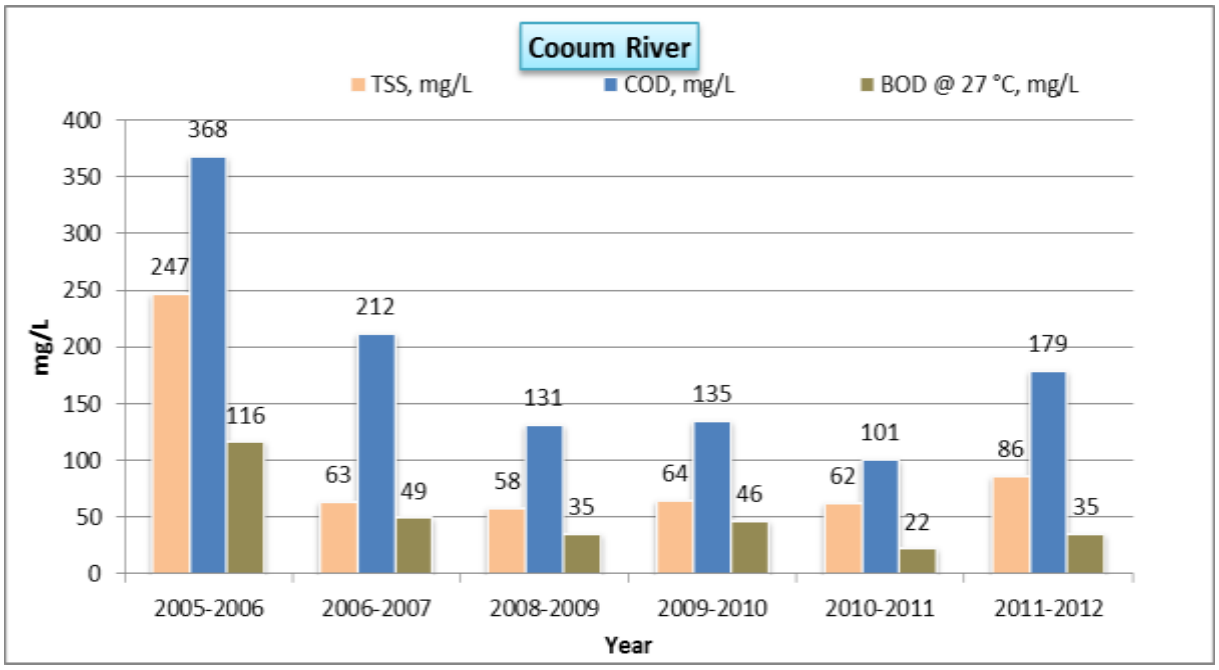


Figure. 2.5 Water quality for the Cooum River (2005-2012)

Table 2.19 Otterinullah River Water Quality Between 2003 &2012

Year	Otterinullah		
	TSS, mg/L	COD, mg/L	BOD @ 27 °C, mg/L
2005-2006	145	252	80
2006-2007	80	199	41
2008-2009	138	191	60
2009-2010	120	159	60
2010-2011	81	129	38
2011-2012	99	229	44

Source: TNPCB Year Book

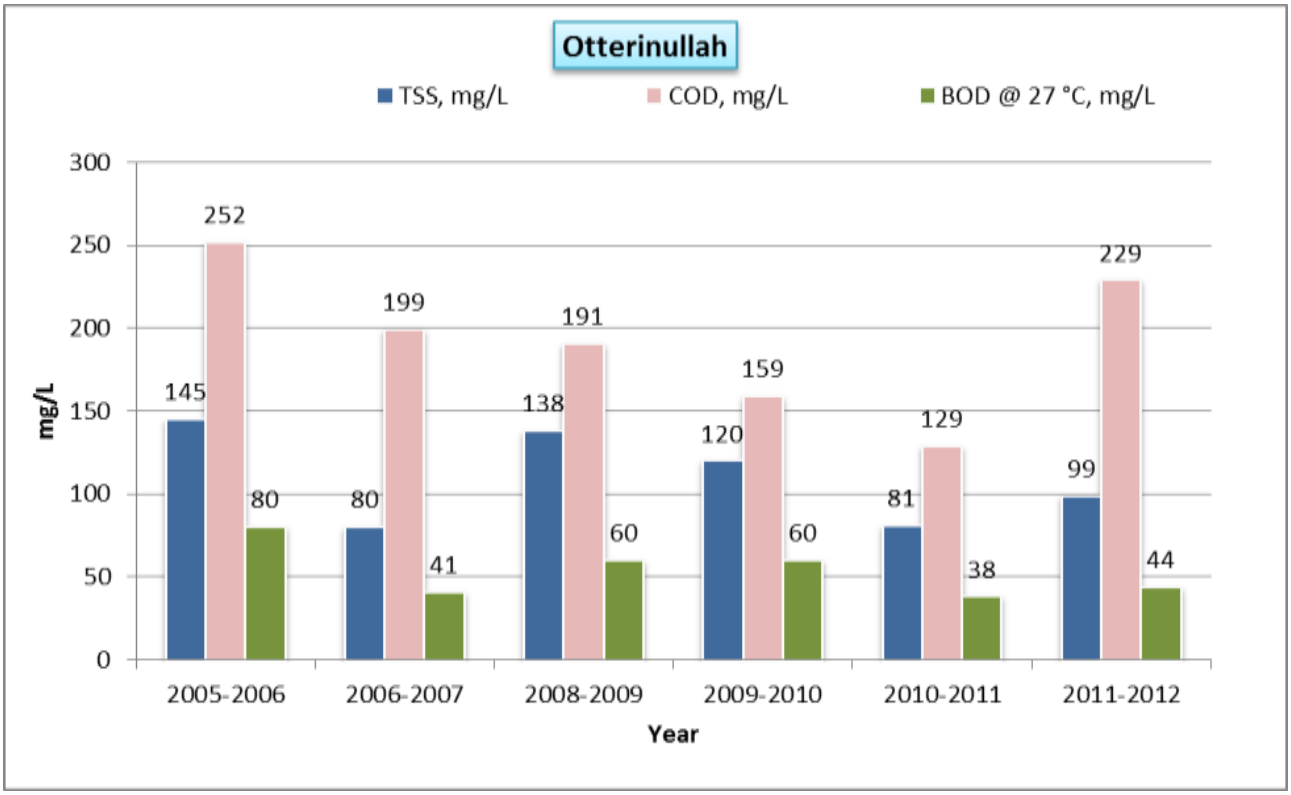


Figure. 2.6 Water quality for the Otterinullah River (2005-2012)

2.3 Lake Water Quality

Table 2.20 Udhagamandalam Lake Water Quality between 2003 &2012

Year	Udhagamandalam Lake			
	pH	Nitrate, mg/L	DO, mg/L	BOD @ 27 °C, mg/L
2004-2005	5.7-8.2	0.44	4.2	10.2
2006-2007	6.49-7.38	1.9	4.9	1.4
2008-2009	6.98	0.99	4.63	8
2009-2010	7.26	2.48	4.68	13
2010-2011	7.57	1	5.5	8.3

Source: TNPCB Year Book

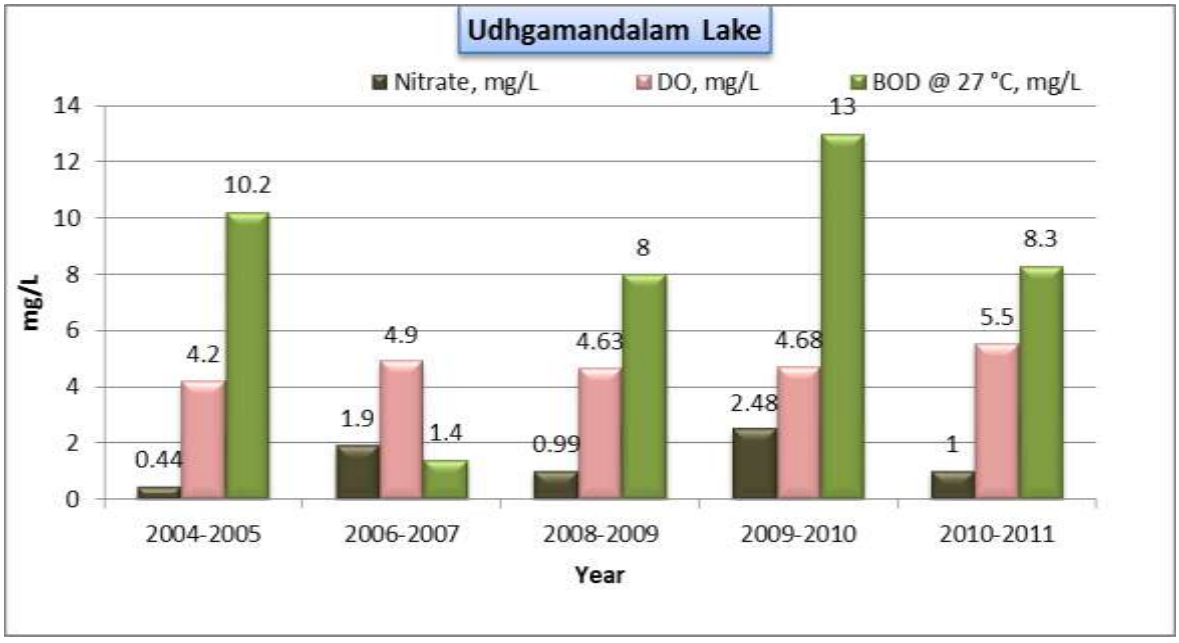


Figure. 2.7 Water quality for the Udhgamandalam Lake (2004-2011)

Table 2.21 Kodaikanal Lake Water Quality Between 2003 & 2012

Year	Kodaikanal Lake			
	pH	Nitrate, mg/L	DO, mg/L	BOD @ 27 °C, mg/L
2004-2005	6.1-8.0	0.09	5.5	7.9
2006-2007	6.19-7.28	0.06	6.53	2.01
2008-2009	6.81	0.09	6.6	4.7
2009-2010	6.51	0.23	6.06	7
2010-2011	6.66	0	0.85	7.27

Source: TNPCB Year Book

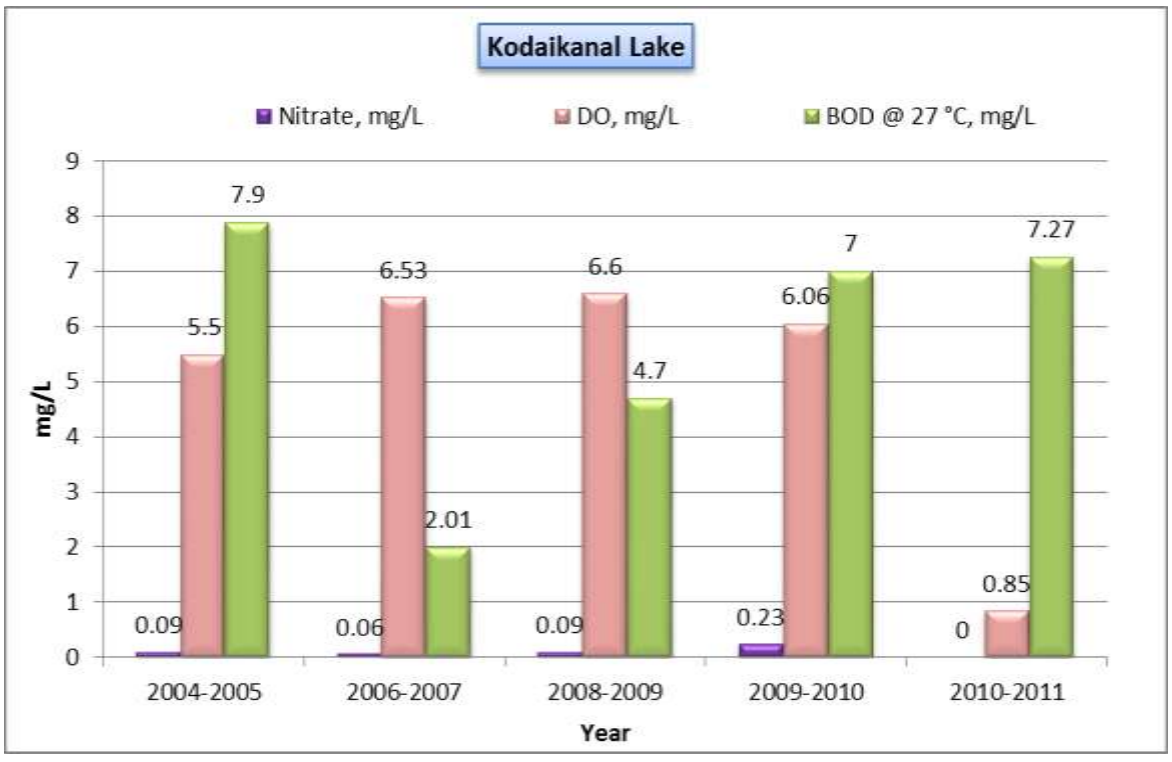


Figure. 2.8 Water quality for the Kodaikanal Lake (2004-2011)

Table 2.22 Yercaud Lake Water Quality Between 2003 & 2012

Year	Yercaud Lake			
	pH	Nitrate, mg/L	DO, mg/L	BOD @ 27 °C, mg/L
2004-2005	6.4-7.9	0.11	7	2.1
2006-2007	6.64-7.87	0.1	6.5	4.1
2008-2009	7	1	6	1
2009-2010	7.63	0.15	6.63	3
2010-2011	7.8	1	6.2	2.2

Source: TNPCB Year Book

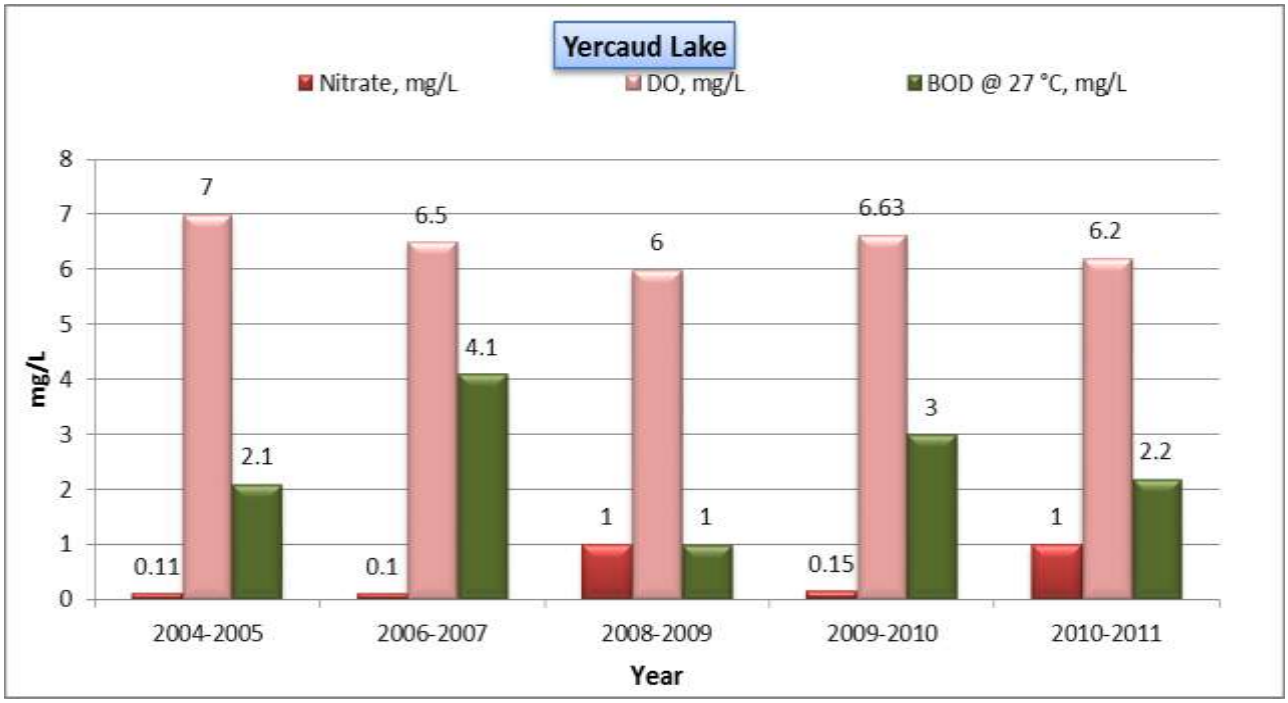


Figure. 2.9 Water quality for the Yercaud Lake (2004-2011)

2.4 Ground Water Data for Tamil Nadu

Every District in Tamil Nadu has been classified based on Ground Water Abstraction. It is classified into different blocks based on the level of Ground Water. The different Blocks are:

1. Safe Block (<70%)
2. Semi-Critical (70-90%)
3. Critical (90-100%)
4. Over-Exploited (>100%)

Current-Senario in Tamil Nadu

Water was traditionally a requirement for Agriculture and domestic use. But in today s world water is a primary resource for Industries, Power Generation, Commercial activities and livestock. The demand for fresh water is very is slowly increasing in many sectors.

The demand from various sectors as assessed by the Institute of Water Studies, Government of Tamil Nadu is given in the Table below.

Table 2.23 Water Consumption Senario in Tamil Nadu

S.no	Sectors		Annual Water demand in TMC
1.	Drinking Water Sector		51.40
	Corporation	13.80 TMC	
	Municipalities	9.60 TMC	
	Town Panchayat	10.00 TMC	
	Rural	18.00 TMC	
2.	Irrigation Sector		1766.00
3.	Industries		54.90
4.	Power		4.20
5.	Live Stock		18.30
	Total Demand		**1894.80**

Source : TWAD

Supply Demand Gap

The Table below depicts the gap between the supply and demand of Water**.**

Table 2.24 Water Supply and Demand Gap in Tamil Nadu

Description	Supply / Demand in TMC
Total Assessed Water Resources	1587.00
Total Demand	1894.80
Supply Demand Gap	307.84

Source: TWAD

Ground Water Potential

Based on the Block Classification, the table below shows the different block classification in Tamil Nadu

Table 2.25 Ground Water Block Classification in Tamil Nadu

Categorization of Blocks	No. of Blocks
Over Exploited (>100%)	**142**
Critical (90-100%)	**33**
Semi- Critical (70-90%)	**57**
Safe (<70%)	**145**
Saline Blocks	**8**
Total	**385**

Source : TWAD

Surface Water Potential in Tamil Nadu

The Total surface water potential of the river basins of Tamil Nadu is assessed at **24160 MCM (853 TCM).**

The details of the breakup of the potential are as under:

- 39000 tanks with a storage capacity of 347 TCM
- 79 reservoirs with a storage capacity of 243 TCM
- Contribution from the other States : 261 TCM
- Other Storages : 2 TCM

The average Run off (surplus flow) to the sea from the 17 Basins of Tamil Nadu State is Computed as 177.12 TCM.

Source: TWAD

Figure. 2.10 Map of Rivers in Tamil Nadu

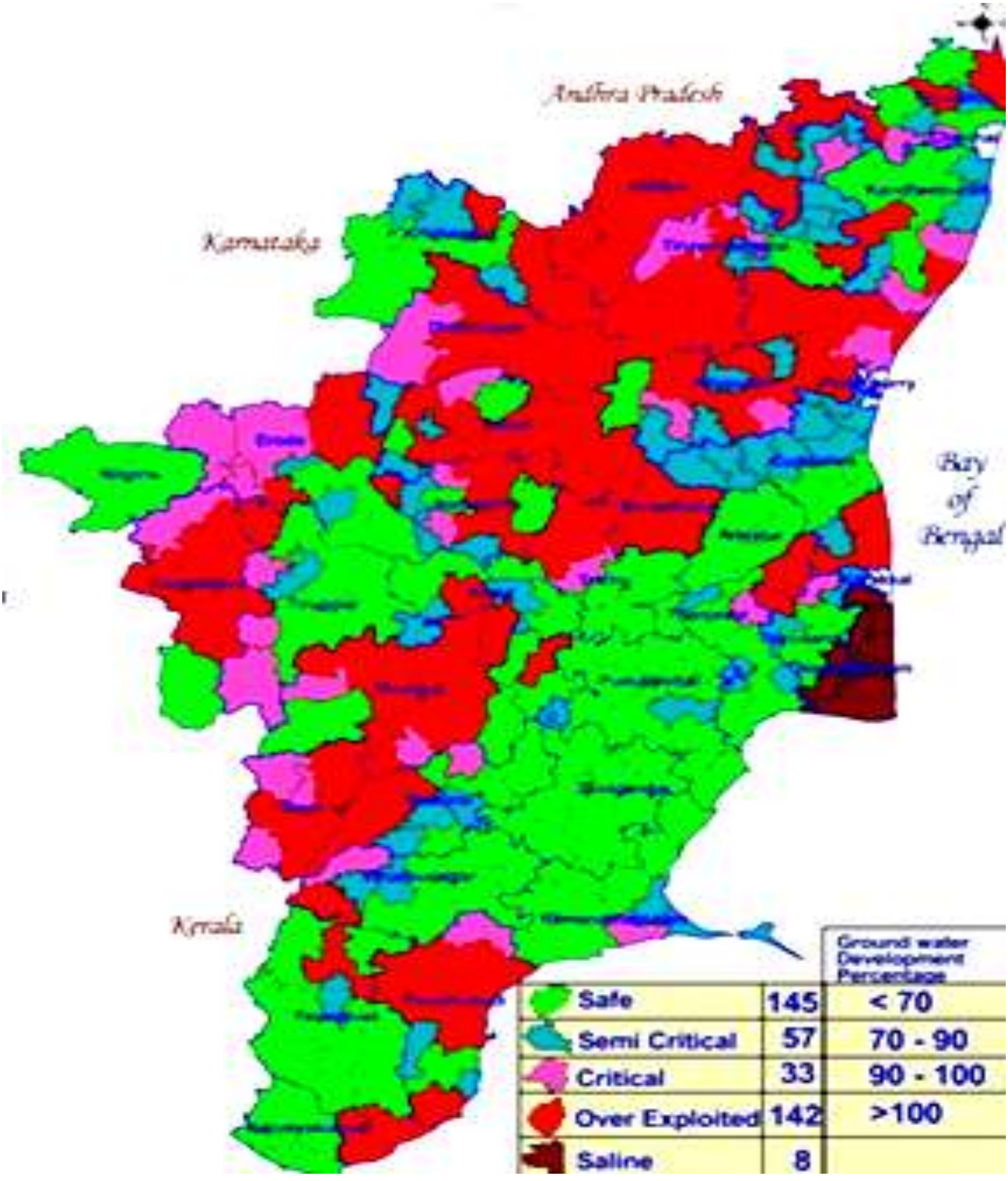


Figure 2.11 Map Showing the Classification of Ground Water Blocks in the State

Source: TWAD

2.5 Coverage of Water Supply In Tamil Nadu

Coverage of Rural Habitations

In Tamil Nadu as on 1.4.2010 there are 93,699 habitations, of which 8,970 habitations are partially covered habitations and 84,729 are fully covered. Rural Habitations are covered through Individual Power Pump Schemes and Combined Water Supply Schemes

Table 2.26 Water Supply Status in Urban Towns

Civic Status	Good	Average	Poor	Total
Corporations (Excluding Chennai)	2	7	-	9
Municipalities	44	93	13	150
Town Panchayats (Erstwhile RTP & UTP)	346	208	5	559
Total	392	308	18	718

Source: TWAD

The following Table Shows the Water Supply Status in the State:

Table 2.27 Water Supply status in Tamil Nadu as on March 2011

S. No	District	Corporations				Municipalities				Town Panchyats				Grand Total
		Good	Avg	Below Avg	Total	Good	Avg	Below Avg	Total	Good	Avg	Below Avg	Total	
1.	Dharmapuri	0	0	0	0	0	1							
2.	Theni	0	0	0	0	4	2	0	6	15	7	0	22	28
3.	Ramanathapuram	0	0	0	0	0	4	0	4	7	0	0	7	11
4.	Tiruppur	1	0	0	1	1	6	0	7	7	9	0	16	24
5.	Dindigul	0	0	0	0	2	0	2	4	9	13	1	23	27
6.	Vellore	0	1	0	1	1	10	2	13	14	7	1	22	36
7.	Madurai	0	1	0	1	1	5	0	6	12	0	0	12	19
8.	Karur	0	0	0	0	0	4	0	4	9	2	0	11	15
9.	Tiruvannamalai	0	0	0	0	0	3	1	4	4	6	0	10	14
10.	Krishnagiri	0	0	0	0	1	1	0	2	5	2	0	7	9
11.	Erode	0	1	0	1	4	4	0	8	37	7	0	44	53
12.	Namakkal	0	0	0	0	2	3	0	5	19	0	0	19	24
13	Sivaganga	0	0	0	0	1	2	0	3	5	7	0	12	15
14.	Salem	0	1	0	1	1	3	0	4	31	2	0	33	38
15.	Thanjavur	0	0	0	0	3	0	0	3	1	48	0	22	25
16.	Kanniyakumari	0	0	0	0	3	1	0	4	27	28	1	56	60
17.	Ariyalur	0	0	0	0	0	2	0	2	1	1	0	2	4
18.	Nagapattinam	0	0	0	0	2	2	0	4	1	7	0	8	12
19.	Coimbatore	0	1	0	1	3	3	0	6	11	33	0	44	51
20.	Perambalur	0	0	0	0	0	1	0	1	0	4	0	4	5
21.	Tiruvallur	0	0	0	0	2	6	4	12	8	5	0	13	25
22.	Virudhunagar	0	0	0	0	0	7	0	7	1	8	0	9	16
23.	Thoothukkudi	0	1	0	1	0	2	0	2	12	6	1	19	22
24.	Tiruvarur	0	0	0	0	3	1	0	4	6	1	0	7	11
25.	Tiruchirappalli	0	1	0	1	1	2	0	3	15	2	0	17	21
26.	Cuddalore	0	0	0	0	4	1	0	5	13	3	0	16	21
27.	Tirunelveli	0	1	0	1	2	5	0	7	22	13	1	36	44
28.	Kancheepuram	0	0	0	0	0	6	4	10	16	8	0	24	34
29.	Viluppuram	0	0	0	0	0	3	0	3	11	4	0	15	18
30.	Pudukkottai	0	0	0	0	1	1	0	2	5	3	0	8	10
31.	Nilgiris	0	0	0	0	2	2	0	4	3	8	0	11	15
	Total	1	8	0	9	44	93	13	150	346	208	5	559	718

Source: TWAD

2.6 Water Pollution in Tamil Nadu

Water Contamination in Tamil Nadu Figure 2.12 Map showing Number of Contaminated Sources in Tamil Nadu

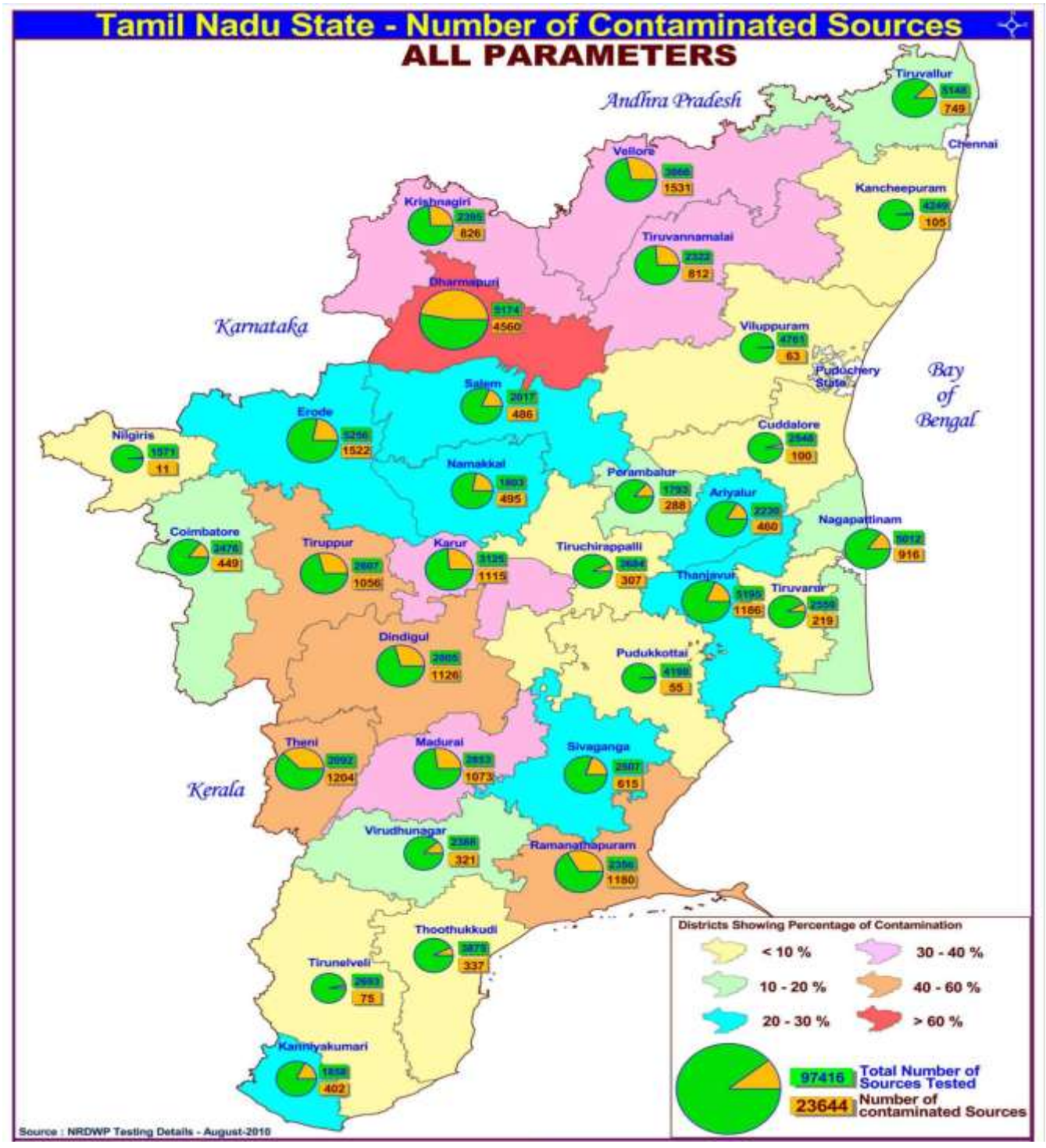
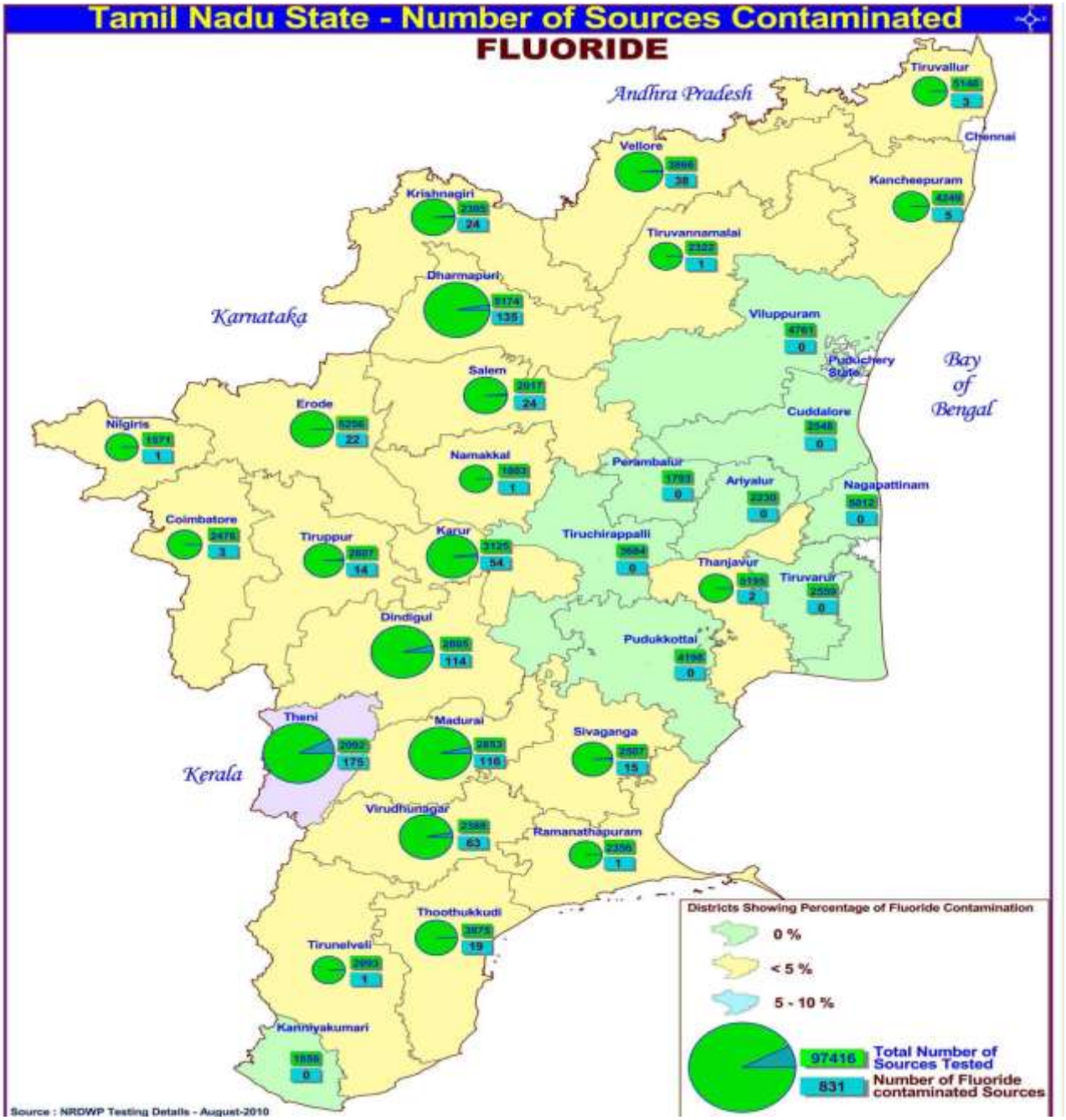


Figure 2.12 Map showing Number of Contaminated Sources in Tamil Nadu

Table 2.28 Water Contamination in the Different Districts

District	Sources Tested	Water Contaminated Sources	Percentage of Contamination
Dharmapuri	5174	4560	88.13
Theni	2092	1204	57.55
Ramanathapuram	2356	1180	50.08
Tiruppur	2607	1056	40.51
Dindigul	2805	1126	40.14
Vellore	3866	1531	39.60
Madurai	2853	1073	37.61
Karur	3125	1115	35.68
Tiruvannamalai	2322	812	34.97
Krishnagiri	2395	826	34.49
Erode	5256	1522	28.96
Namakkal	1803	495	27.45
Sivaganga	2507	615	24.53
Salem	2017	486	24.10
Thanjavur	5195	1186	22.83
Kanniyakumari	1858	402	21.64
Ariyalur	2230	460	20.63
Nagapattinam	5012	916	18.28
Coimbatore	2476	449	18.13
Perambalur	1793	288	16.06
Tiruvallur	5148	749	14.55
Virudhunagar	2388	321	13.44
Thoothukkudi	3875	337	8.70
Tiruvarur	2559	219	8.56
Tiruchirappalli	3684	307	8.33
Cuddalore	2548	100	3,92
Tirunelveli	2693	75	2.78
Kancheepuram	4249.	105	2.47
Viluppuram	4761	63	1.32
Pudukkottai	4198	55	1.31
Nilgiris	1571	11	0.70
Total	**97416**	**23644**	**24.27**

Figure 2.13 Map showing Fluoride Contaminated sources in Tamil Nadu



Source: TWAD

From the above it is seen that Theni District is the highest in terms of Contamination Levels with 8.37% of the samples being Contaminated. The districts of Kanniyakumari, Ariyalur , Nagapattinam, Tiruvarur, Tiruchirappalli , Cuddalore, Viluppuram , Pudukkottai have no fluoride contamination .

Nitrate Contamination in Tamil Nadu

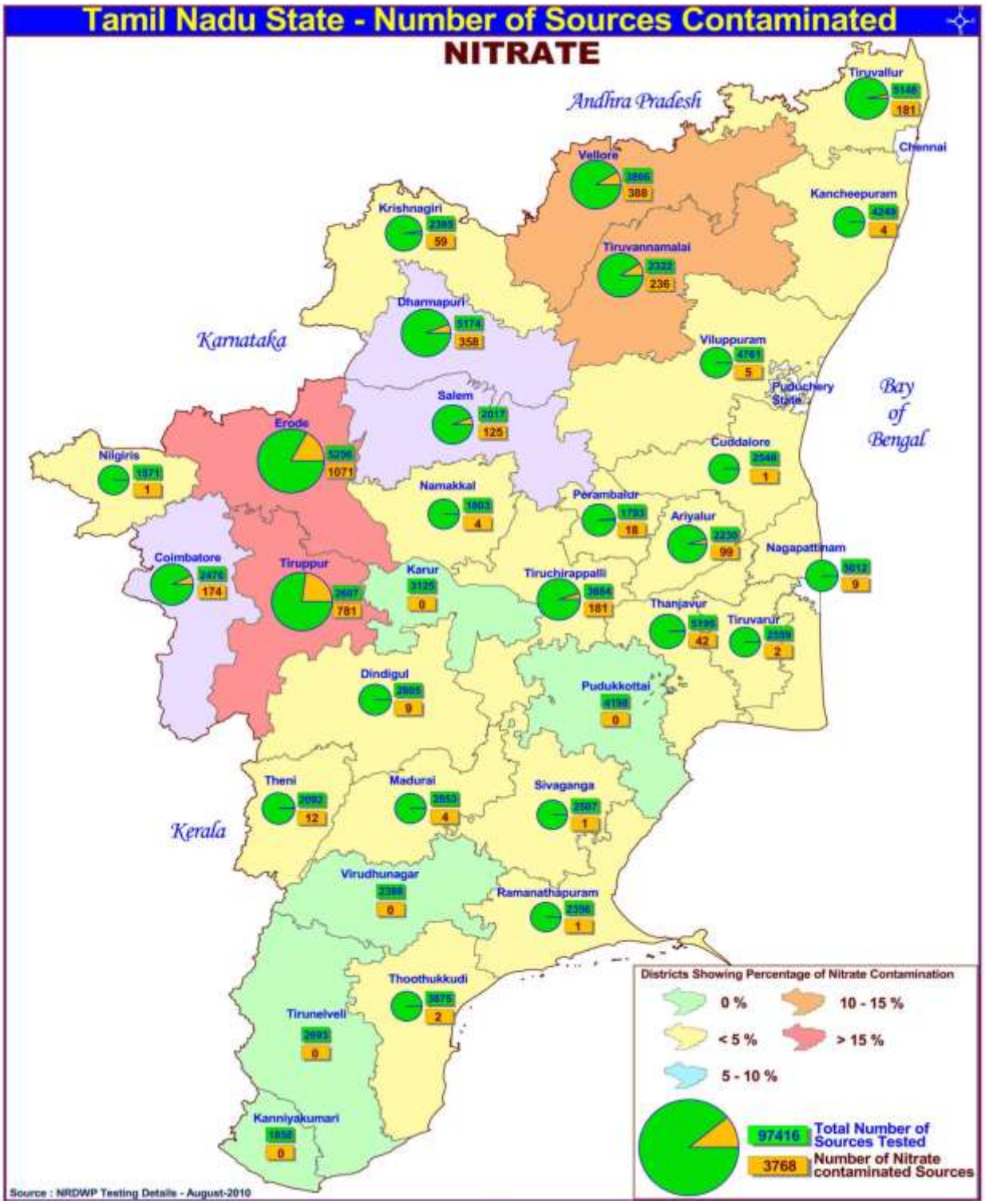


Figure 2.14. Map showing Nitrate Contaminated sources in Tamil Nadu

Table 2.30 Nitrate Contamination in Tamil Nadu

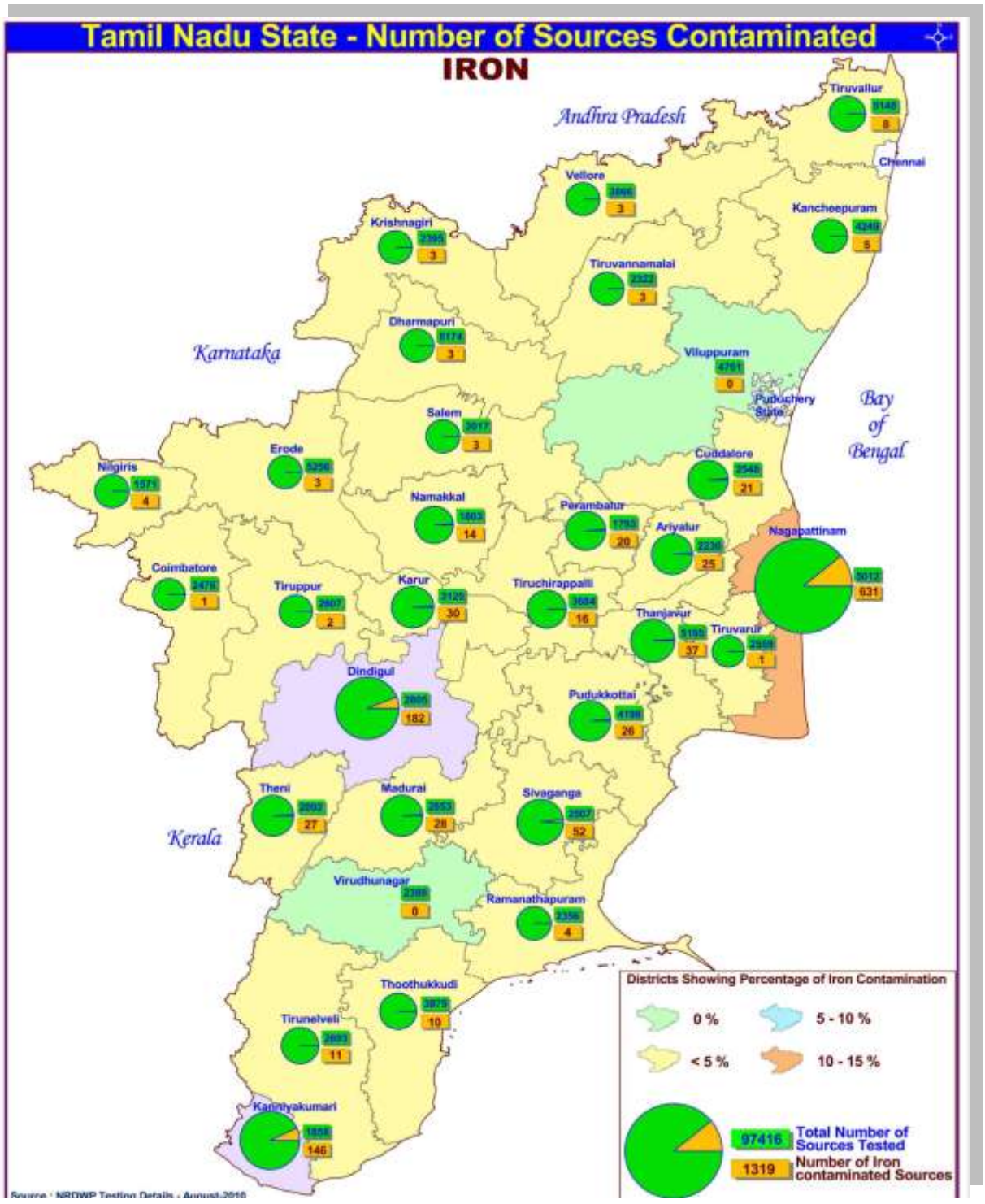
District	Sources Tested	Nitrate Contaminated Sources	Percentage of Contamination
Dharmapuri	5174	358	6.92
Theni	2092	12	0.57
Ramanathapuram	2356	1	0.04
Tiruppur	2607	781	29.96
Dindigul	2805	9	0.32
Vellore	3866	388	10.04
Madurai	2853	4	0.14
Karur	3125	0	0.00
Tiruvannamalai	2322	236	10.16
Krishnagiri	2395	56	2.46
Erode	5256	1071	20.38
Namakkal	1803	4	0.22
Sivaganga	2507	1	0.04
Salem	2017	125	6.20
Thanjavur	5195	42	0.81
Kanniyakumari	1858	0	0.00
Ariyalur	2230	99	4.44
Nagapattinam	5012	9	0.18
Coimbatore	2476	174	7.03
Perambalur	1793	18	1.00
Tiruvallur	5148	181	3.52
Virudhunagar	2388	0	0.00
Thoothukkudi	3875	2	0.05
Tiruvarur	2559	2	0.08
Tiruchirappalli	3684	181	4.91
Cuddalore	2548	1	0.04
Tirunelveli	2693	0	0.00
Kancheepuram	4249.	4	0.09
Viluppuram	4761	5	0.11
Pudukkottai	4198	0	0.00
Nilgiris	1571	1	0.06
Total	**97416**	**3768**	**3.87**

From the above it is seen that the districts of Tiruppur and Erode have high levels of Nitrate Contamination , this is due to the presence of Many Polluting Industries

Iron Contamination : Table 2.31 Iron contamination in Tamil Nadu

District	Sources Tested	Iron Contaminated Sources	Percentage of Contamination
Dharmapuri	5174	3	0.06
Theni	2092	27	1.29
Ramanathapuram	2356	4	0.17
Tiruppur	2607	2	0.08
Dindigul	2805	182	6.49
Vellore	3866	3	0.08
Madurai	2853	28	0.98
Karur	3125	30	0.96
Tiruvannamalai	2322	3	0.13
Krishnagiri	2395	3	0.13
Erode	5256	3	0.06
Namakkal	1803	14	0.78
Sivaganga	2507	52	2.07
Salem	2017	3	0.15
Thanjavur	5195	37	0.71
Kanniyakumari	1858	146	7.86
Ariyalur	2230	25	1.12
Nagapattinam	5012	631	12.59
Coimbatore	2476	1	0.04
Perambalur	1793	20	1.12
Tiruvallur	5148	8	0.16
Virudhunagar	2388	0	0.00
Thoothukkudi	3875	10	0.26
Tiruvarur	2559	1	0.04
Tiruchirappalli	3684	16	0.43
Cuddalore	2548	21	0.82
Tirunelveli	2693	11	0.41
Kancheepuram	4249.	5	0.12
Viluppuram	4761	0	0.00
Pudukkottai	4198	26	0.62
Nilgiris	1571	4	0.25
Total	**97416**	**1391**	**1.35**

Figure 2.15. Map showing Iron Contaminated sources in Tamil Nadu



From the Table 2.31 it is seen that the district of Nagapattinam is highly contaminated with Iron at 12.59%

Fecal Coliform Contamination

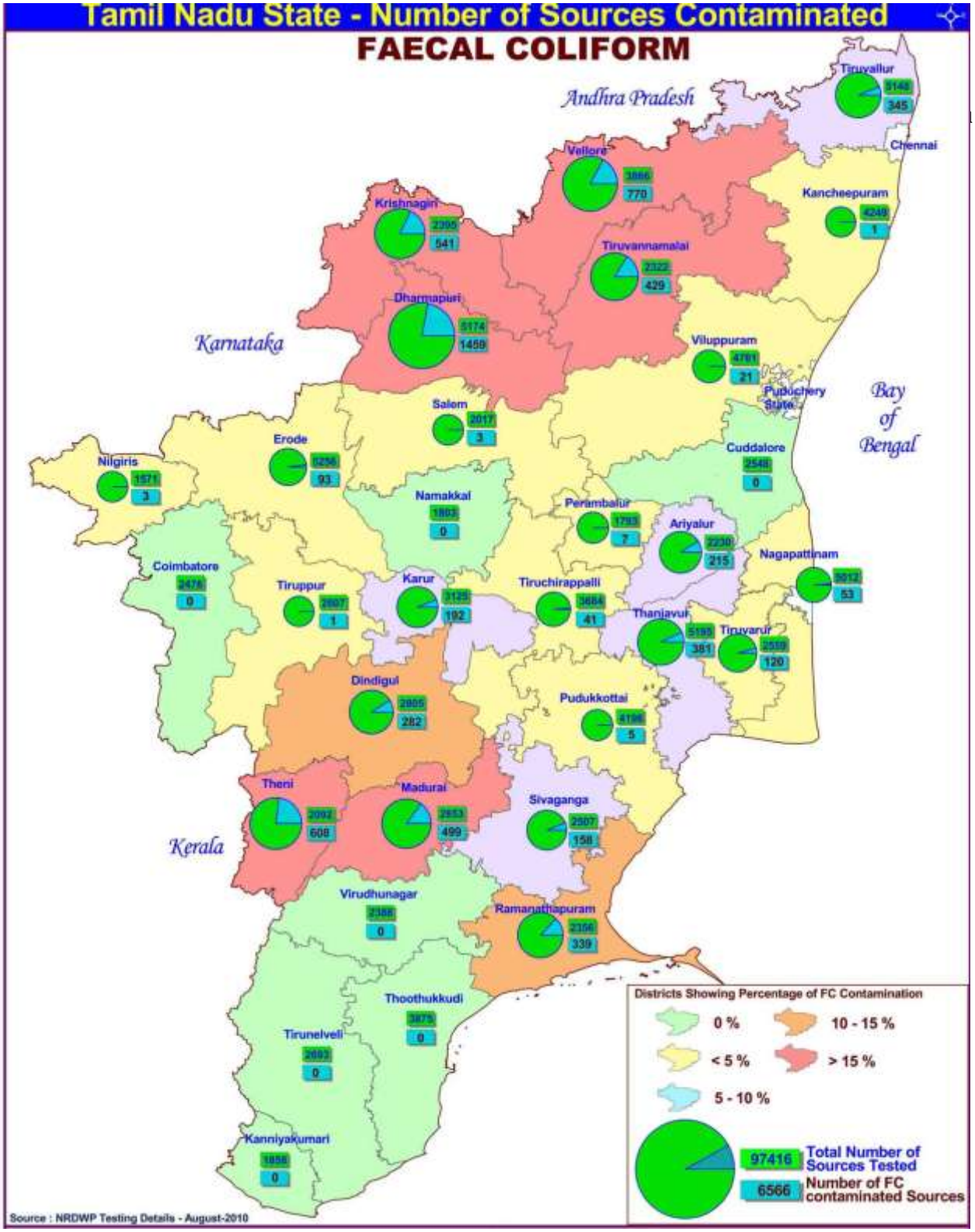


Table 2.32 Fecal Coliform contamination in Tamil Nadu

District	Sources Tested	Fecal Coliform Contaminated Sources	Percentage of Contamination
Dharmapuri	5174	1459	28.20
Theni	2092	608	29.06
Ramanathapuram	2356	339	14.39
Tiruppur	2607	1	0.04
Dindigul	2805	282	10.05
Vellore	3866	770	19.92
Madurai	2853	449	15.74
Karur	3125	192	6.14
Tiruvannamalai	2322	429	18.48
Krishnagiri	2395	541	22.59
Erode	5256	93	1.77
Namakkal	1803	0	0.00
Sivaganga	2507	158	6.30
Salem	2017	3	0.15
Thanjavur	5195	381	7.33
Kanniyakumari	1858	0	0.00
Ariyalur	2230	215	9.64
Nagapattinam	5012	53	1.06
Coimbatore	2476	0	0.00
Perambalur	1793	7	0.39
Tiruvallur	5148	345	6.70
Virudhunagar	2388	0	0.00
Thoothukkudi	3875	0	0.00
Tiruvarur	2559	129	5.04
Tiruchirappalli	3684	41	1.11
Cuddalore	2548	0	0.00
Tirunelveli	2693	0	0.00
Kancheepuram	4249.	1	0.02
Viluppuram	4761	21	0.44
Pudukkottai	4198	5	0.12
Nilgiris	1571	3	0.19
Total	**97416**	**6566**	**6.69**

2.7 Existing Sewerage System In Chennai

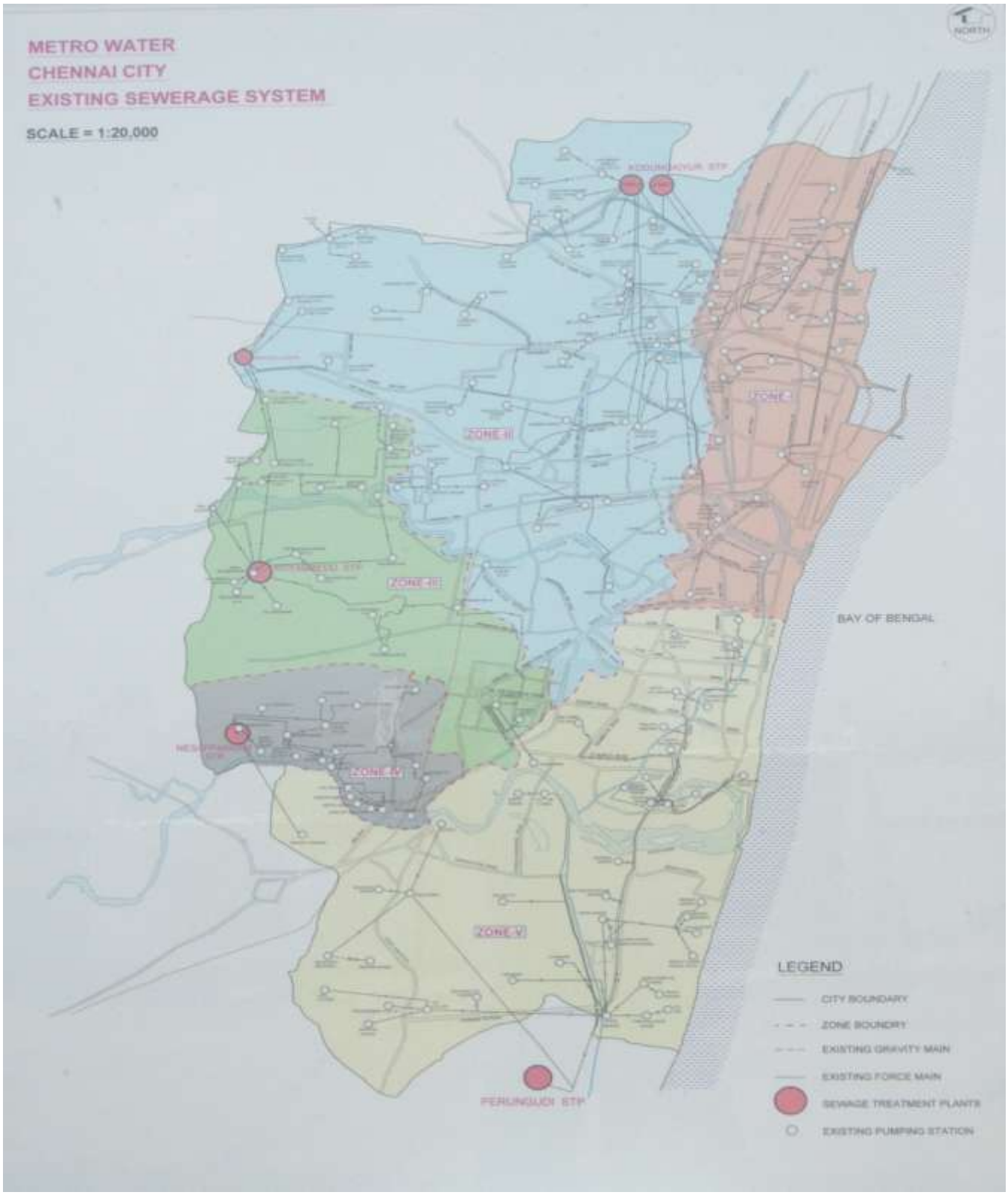


Figure 2.17. Map showing the existing sewage network in Chennai

Table 2.33 Capacity Of Existing Sewage Treatment Plants In Tamil Nadu

S. No	Name of Scheme	STP Capacity and technology	Present Flow in	Raw Sewage			Effluent		
			MLD	BOD (mg/l)	E.coli MPN /100ml	TSS Mg/ml	BOD (mg/l)	E.coli MPN /100ml	TSS Mg/ml
1.	Tanjavur	28.05 MLD	14.00	93	300000	170	18	5000	30
2.	Trichy	59 MLD	35.00	240	230000	170	18	4700	26
3.	Karur-Inam Karur	15.00 MLD EASP	-	-	-	-	-	-	-
4.	Tirunelveli	24.02-MLD WSP	-	-	-	-	-	-	-
5.	Mayiladuthur	5.85 MLD-WSP	-	-	-	-	-	-	-

Source : TWAD

Table 2.34 Stps In Chennai

1.	**Kodungaiyur Zone I & II**	**110 MLD**
2.	**Koyembedu- Zone III**	**60 MLD**
3.	**Nesapakkam-Zone IV**	**40 MLD**
4.	**Perungudi-Zone V**	**54 MLD**

- The present capacity of the treatment plants in Chennai is 486 MLD.
- Due to the enhancement of capacity of the 28 sewage pumping stations and construction of 3 new pumping stations, the pumping capacity has been increased from 440 MLD to 575 MLD. The capacity of the sewerage treatment plants has been increased from 222 MLD to 486 MLD and the sewage overflow and untreated sewage entering the waterways have been reduced. About 36 MLD of secondary treated sewage is being supplied to CPCL and MFL besides 5 MLD of raw sewage to GMR Vasavi Power Corporation.
- In the sewage treatment process, bio-gas is produced and is being used to produce power to run the plants. This incidentally reduces the discharge of Green House Gas into the atmosphere and provides for Carbon Trading. CMWSS Board has adopted Clean Development Mechanism (CDM) which leads to savings in energy cost to a turn of Rs.43.05 lakhs per month.

2.8 Status on Effluent Treatment Plants in Tamil Nadu

Effluent treatment plants or Industrial waste water treatment plants are used to treat industrial effluents. Many chemical, textile, Bleaching and tannery etc. industries generate a lot of effluents which are highly toxic in nature if passed into the environment untreated. Untreated effluent contains high levels of BOD, COD, TSS, TDS and varying ph. If passed into nearby rivers or lakes. They can cause damage to both the flora and fauna. It is mandatory for these industries to have an effluent treatment plant or have a connection to a Common Effluent treatment plant.

Table 2.35 Number of CETP in Tamil Nadu

State	Number of CETPs	Number as % of Total in India	Combined capacity of CETPs in Tamil Nadu, MLD	Combined capacity as % of total capacity of India
Tamil Nadu	29	33	71.15	12.85

Source: CPCB Performance Status of Common Effluent Treatment Plants, 2005

Table 2.36 Number of CETP complying with standards in Tamil Nadu, 2005

State	Number of CETPs studied by CPCB	CETPs complying pH, BOD, COD, TSS and TDS standards		CETPs complying pH, BOD, COD and TSS but not complying TDS standard	
		Number	Name	Number	Name
Tamil Nadu	29	0	-	2	Thiruvai Karur,TALCO Ambur Thuthipet

The salient features highlighting issues connected to CETP(s) are listed as below:

Common Effluent Treatment Plants (CETPs), Tirupur:

i. A total of eight CETP(s) handle the industrial waste waters from 281 units (Textile) with capacities ranging from 1.5 to 10 MLD and discharge the treated waste waters into river Noyyal which ultimately gets impounded in Orathupalayam dam. The dam water is meant to be used as irrigation water.

ii. The results of analysis clearly show that the CETP(s) have been designed towards

primary treatment only using lime, alum and poly-electrolytes as coagulation agents.

iii. The incoming TDS in the ETP range between 6000-9000 mg/l and slight increase was noticed in the treated effluents, perhaps due to soluble fractions of coagulants during treatment. As such CETP(s) remove only the colour and other suspended organic matter.

iv. As against standard (2100 mg/l) for TDS, the existing TDS levels above 5000 mg/l is a severe gross violation. The Noyyal River and ground water survey in Tirupur shows that TDS has grossly contaminated the waters. As such the water is not fit for irrigation in the downstream stretches.

v. The CETP(s) remove only 40% of the COD, BOD and most of the time the BOD of the treated waste waters is above 100 mg/l as against limiting standard of 30 mg/l for discharge into river waters. This is yet another non-compliance by the CETP(s).

vi. It is generally seen that Sodium (Na+) and Chloride (Cl-) ions dominate in the wastewaters indicating use of common salt (NaCl) in the dyeing processes. Relatively lower levels of Sulphates (SO4--) indicate that Sodium Sulphate (Na2SO4) is used to a much lesser extent.

vii. Generally Sodium Chloride is recoverable (50-70%) from Dye bath solutions using nano filtration membranes and recovered Brine is reusable in dyeing processes along with low hardness water recovered through Reverse Osmosis processes. Almost 33 individual Units are in the process of installing R.O./Nano Systems followed by Multi Stage evaporator systems (MSES) to attain zero discharge from these Units.

viii. In order to reverse the ecological damages in the area, the existing CETP(s) shall also require upgradation in terms of R.O/Nano systems followed by MSES to constrain high TDS discharges into the river. The approximate expenditure towards this has been worked out as high as 126 crores Indian Rupees and almost 35 crores for routing operation and maintenance of these systems.

ix. It is worthwhile to mention that all the CETP(s) in Tamil Nadu has enjoyed part funding from Government of India (MoEF) and failed to keep pollution under

control.

x. South Zonal Office of CPCB is interacting with companies that may deliver 97% of NaCl recovery which shall help in alleviating the need for a MSES (which is expensive to operate) in CETP(s).

xi. Common Effluent Treatment Plants (CETPs), Karur:

Yet another 8 Nos of CETP(s) are in operation at Karur where primarily yarn dyeing is prevailing. The treated effluents are being discharged into river Amaravati basin, which is a tributary to river Cauvery. The salient features are given below:

i) The design of CETP(s) is similar to that of CETP(s) in Tirupur and as such fail to constrain TDS during treatment process. Though not many complaints are arising from the area, yet the ground and surface waters may be subjected to gradual increase in TDS and shortly the Tirupur scenario could be repeat.

ii) An action plan as a preventive strategy shall be formulated and implemented on the lines of CETP(s) at Tirupur by TNPCB. The common salt (NaCl) recovered shall be reusable in the dye house.

iii) Huge quantities of hazardous CETP sludges are being stored in CETP premises that require safe disposal.

Common Effluent Treatment Plants CETPs), Vellore:

There are 10 nos of CETP(s) in operation in the Vellore district and handling industrial effluents from Tannery sector and discharging treated effluents in Palar river basin. There is no water flow in River Palar at present due to construction of many water reservoirs across the tributaries in AP and Karnataka. Due to high permeability of riverbed, the treated effluents infiltrate into the soil and almost little (or no) discharge is visible in the river. The salient features are listed as below:

i) Generally there are three types of wastewater from tanneries i.e soaking effluent, chromium effluent and other wastewater. Soaking wastewater containing high TDS is commonly allowed for solar evaporation either in the premises or at CETPs.

ii) It is reported that about 600 and odd numbers of tannery units are in operation in the District of Vellore. Most of the tanneries are linked with CETPs and some are having

individual effluent treatment plants. The effluents are generally high in TDS and BOD and CETP(s) also receives chromium in significant concentrations.

iii) The designed capacities of the CETPs are ranging from 1000 m^3/D to 4400 m^3/D. The CETP comprising collection/equalization tank, Chemical flocculation, primary clarifier, anaerobic lagoon/aeration tank, secondary clarifier and sludge filter (Mechanical filter). Some of the CETPs are having centralized solar evaporation systems for evaporating high TDS effluents and some are having Chrome Recovery Plant (CRP).

iv) Only a few CETPs are meeting the standards in terms of BOD and none of the CETPs are meeting the standard in terms of TDS as stipulated by Tamil Nadu Pollution Control Board. None of the CETPs have been issued either Consent Order or direction by TNPCB.

As per the direction of Hon'ble Supreme Court, all the units generating the sludge out of ETP operation should be disposed with in the premises by providing a secured land fill the guidelines and norms stipulated by CPCB. But none of the CETPs which were monitored had the secured land fill. Hazardous waste disposal facilities were not found scientifically sound. Chromium containing wastes had been dumped in unscientific manner that have to be taken to secured landfill. Common TSDF is required for this purpose.

Table 2.37 CETPs' capacity, year of establishment, capital cost and related information

S. No.	CETP Tamil Nadu	Capacity MLD	Year of Establishment	Capital cost, lac*	Name/address of CETP/company
1	Mannarai CETP, Tirupur	4.2	1999	135.5(G)+ 108(M)	M/s. Mannarai CETP Ltd., Tirupur
2	Kashipalayam CETP, Tirupur	4	1999	110(G) + 240(M)	M/s. Kasipalayam CETP Ltd., Tirupur
3	Veerapondi CETP, Tirupur	10	1999	336(G) + 384(M)	M/s.Veerapondi CETP Ltd., Tirupur
4	Manickapuram Pudur CETP, Tirupur	1.6	1999	63.5(G) + 63.5(M)	M/s.Manickapuram Pudur CETP Ltd., Tirupur
5	Kunnangalpalay am CETP, Tirupur	4.25	1999	108(G) + 108(M)	M/s. Kunnangalpalayam CETP Ltd., Tirupur
6	Andipalayam CETP, Tirupur	5	1999	107.5(G) + 171.25(M)	M/s. Andipalayam CETP Ltd., Tirupur
7	Angeripalayam CETP, Tirupur	8.5	1999		M/s. Angeripalayam CETP Ltd., Tirupur
8	Chinnakkarai CETP Ltd., Tirupur	5	1999	122.5(G) + 183(M	M/s. Chinnakkarai CETP Ltd., Tirupur
9	Andakovil CETP, Karur				Karur Andakovil Effluent Treatment, Karur
10	KS CETP, Karur				KS Common Effluent Treatment, Karur
11	KKEL CETP, Karur	1.3	1999	100(G) + 56.4(M)+ 43.6(L)	Karur Karuppampalayam Envirotech Ltd. (KKEL), Karur
12	Sellandi Palayam CETP, Karur				Karur Sellandi Palayam Pollution Control Ltd, Karur
13	Thiruvai CETP, Karur	2.1	1999	104(G) + 41(M)+ 63(L)	Karur Thiruvai Pollution Control Ltd, Karur
14	Valandi Dyeing CETP, Karur				Karur Valandi Dyeing Envirotech Ltd, Karur
15	Taluk Dye & Bleaching CETP, Karur				Karur Taluk Dye & Bleaching Effluent Treatment Plant Ltd, Karur
16	Amaravathi Poll Tech CETP, karur	2.4	1999	122(G) + 32(M)+ 90(L)	Amaravathi Poll Tech Ltd., Karur
17	TALCO	2.8	May 1991	189.25(G) +	TALCO Vaniyambadi

	Vaniyambadi, Valayampet, CETP, Vellore			33.25(M)+ 112.5(L)	Enviro control systems Ltd, 183 Cutchery Road Extension, Valayampet, Vaniyambadi- 635754
18	TALCO Vaniyambadi, Udayendiram CETP, Vellore	0.2	January 1996	30(G) + 40(M)	TALCO Vaniyambadi Enviro control systems Ltd, 183 Cutchery Road Extension, Udayendiram, Vaniyambadi- 635754
19	TALCO Perinambut CETP	0.9	August 1995	80(G) + 80(M)+ 40(L)	TALCO Perinambut Tanners Effluent Treatment Co.,Ltd., Bakkalapalli Sector, No 299/A High Road, Pernambut- 635810
20	TALCO Ambur Thuthipet CETP, Vellore	2	November 1994	178.5(G) + 356.5(M)	TALCO Ambur Tannery Effluent Treatment Co.Ltd. Post Box No. 21, Periyavarikkam, Thuthipet, Ambur- 635811 Distt. Vellore
21	Visharam CETP, Melvisharam Vellore	3.4	October 1996	98.25(G) + 92.29(M)+ 175(L)	Visharam Tanners Enviro Control Systems Pvt Ltd, No. 306, 307, C, Abdul Hakeem Road, Melvisharam- 632509 Distt. Vellore
22	TALCO Ranipet CETP, Vellore	4	February 1996		TALCO Ranipet Tannery Effluent Treatment Co. Ltd., VC Mottor Village, Vennivedu Post, Walajah, Distt. Vellore- 632513
23	Melpudupet CETP, Ambur, Vellore				Melvisharam Tanners Effluent Treatment Co,Pvt Ltd.,Melpudupet Sector, Walajha taluk
24	Ambur Mallgalthope CETP, Vellore	1.1	August 1998	100(G) + 70(M)+ 100(L)	Ambur Tannery Effluent Treatment Co.Ltd. Kaspa Road, Ambur- 635802
25	SIDCO Ranipet CETP, Vellore	2.5	December 1995	100(G) + 81.04(M)+ 138.96(L	Ranipet SIDCO Finished Leather Effluent Treatment Co.Pvt Ltd, Plot 199, SIDCO Industrial Estate, SIPCOT, Ranipet- 632403
26	SIDCO phase II CETP Ranipet, Vellore				SIPCOT & SIDCO phase II Entrepreneur Co Pvt Ltd, Ranipet

27	TALCO Dindigul CETP	2.5	December 1996	245(G) + 142(M)+ 120(L)	TALCO Dindigul Tanners Enviro Control Systems Pvt Ltd, Batlagundu Bye Pass Road, Begambur Post, Dindigul- 624002
28	TALCO Madhavaram CETP, Chennai	0.4	January 1997	280	Madhavaram Leather Manufacturers Facility Pvt Ltd., H 3, TALCO Industrial Estate, Madhavaram, Chennai- 60
29	Pallavaram CETP, Chennai	3	February 1995	100(G) + 174.8(M)+ 462(L)	Pallavaram tanners Industrial Effluent Co. Ltd., 105, Anna Salai, Nagalkeni, Chromepet, Chennai- 44

*(G):Govt. contribution, (M):Members contribution, (L):Loan

Source : CPCB Performance Status of Common Effluent Treatment Plants, 2005

Table 2.38 Status of Sewerage System Coverage

DETAILS	1978	MARCH 2010
Area covered	74 %	100 %
No. of dwellings with sewer connections	1,14,000	5,98,249
Length of Sewer Line	1,223 km	2,677 km
No. of pumping stations	58	196
Treatment Plants	3 No.s	5 No.s
Treatment capacity	57 MLD	486 MLD

Source : TWAD

2.9 Diseases Due To Water Pollution in the State

Untreated sewage contains many harmful bacteria . E . Coli is one such example , Contamination of Ground Water / Surface Water by Untreated sewage can cause diseases such as ADD , cholera etc. ADD- also known as Acute Diarrheal Diseases is one of the main Diseases arising due to drinking Contaminated Water.

Table 2.39 District wise ADD cases and deaths for the year 2003-2005

Sn No	Districts	2003		2004		2005	
		Cs	Ds	Cs	Ds	Cs	Ds
1	Kancheepuram	4452	1	2685	1	3076	7
2	Tiruvellur	4038	7	6800	4	7804	1
3	Cuddalore	3176	5	6322	11	7639	9
4	Vilipuram	2121	0	2852	7	2961	10
5	Vellore	5884	16	5716	15	4038	4
6	T.V.Malai	8167	1	7389	1	8003	3
7	Dharmapuri	1797	7	394	1	884	5
8	Salem	464	1	76	3	16	0
9	Namakkal	889	1	1570	0	1184	1
10	Erode	1905	1	2184	0	1413	0
11	Coimbatore	1594	0	2456	4	2763	3
12	The Nilgiris	7	2	77	1	6	1
13	Tiruchi	771	4	2026	7	1458	3
14	Karur	322	0	335	0	393	0
15	Perambalur	56	1	54	0	81	0
16	Pudukotai	1711	1	2486	2	1877	1
17	Thanjavur	232	2	538	2	817	0
18	Tiruvarur	1265	1	1242	1	759	0
19	Nagapattinam	399	6	810	8	678	2
20	Madurai	5476	0	6995	11	8889	3
21	Theni	3065	1	2842	0	2482	1
22	Dindugal	3071	3	4033	2	3514	0
23	Virudunagar	1168	1	3079	11	1937	0
24	Ramanathapuram	723	1	2686	10	937	6
25	Sivaganga	545	0	1548	5	1055	2
26	Tirunelveli	2463	3	2918	1	1997	3
27	Tuticorin	1308	0	1723	9	838	0
28	Kanyakumari	3	0	40	0	15	0
29	Chennai	2399	0	4524	2	3104	0
	Total	**59471**	**66**	**77400**	**119**	**70618**	**65**

Cont. Table 2.40 District wise ADD cases and deaths for the year 2006-2013

Sn No	Districts	2006		2007		2008		2009		2010		2011		2012		2013	
		Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds
1	Kancheepuram	3402	0	1649	2	1576	1	1855	3	545	3	8639	1	2436	1	4725	2
2	Tiruvellur	6606	0	6420	0	6655	4	4823	0	8583	0	5764	2	4740	0	4726	5
3	Cuddalore	7217	2	8758	2	8522	10	7459	2	6124	1	16440	4	20875	0	31026	1
4	Vilipuram	1850	2	955	2	787	7	12219	2	655	5	4890	5	11549	0	10759	2
5	Vellore	3400	0	3805	4	3871	5	2700	0	3355	1	10840	0	11241	0	9644	3
6	T.V.Malai	6499	1	6425	2	7311	0	7371	1	9423	0	10963	1	12497	0	12754	1
7	Dharmapuri	7	0	1	0	57	3	124	0	106	3	3471	0	209	2	179	0
8	Krishnagiri	251	3	160	1	115	1	62	1	260	8	3171	0	5248	2	4120	4
9	Salem	27	0	11	0	4	3	7021	2	268	0	9524	0	10185	0	2792	2
10	Namakkal	497	1	501	3	287	0	245	1	12	0	92	1	166	0	102	0
11	Erode	1509	2	495	0	1622	0	1461	0	814	0	6284	0	5171	0	4040	0
12	Coimbatore	1846	1	1374	0	1447	0	835	0	538	0	2897	0	2243	0	1645	0
13	Tiruppur			0	0	0	0			539	0	301	0	61	0	609	0
14	The Nilgiris	0	0	0	0	34	0	97	0	0	0	3713	0	6698	0	4246	0
15	Tiruchi	1368	1	2482	2	5324	0	4648	0	5218	3	18151	0	15459	1	14097	0
16	Karur	522	1	0	0	0	0	656	1	34	0	1954	0	1713	0	1581	0
17	Perambalur	596	0	156	1	199	4	169	3	230	0	15386	0	12439	0	13002	1
18	Pudukotai	319	3	601	2	418	0	335	1	32	0	12216	1	7157	0	5214	0
19	Thanjavur	199	1	175	0	625	0	1760	0	715	1	1070	3	1113	2	1481	2
20	Tiruvarur	273	0	15	0	61	1	6852	0	419	1	10856	0	9597	0	11435	0
21	Nagapattinam	500	0	21	0	1611	3	3	0	0	0	844	0	451	0	1185	0
22	Madurai	6424	1	7247	2	7416	7	7528	0	7433	2	6084	1	7166	2	4524	0
23	Theni	366	0	22	0	159	1	3062	0	6540	5	5333	0	5079	0	4252	0
24	Dindugal	2804	0	3211	2	4351	3	4467	1	5363	5	5931	3	5334	3	4551	0
25	Virudunagar	1015	0	347	0	561	2	1212	0	2009	1	2417	0	2640	3	2236	1
26	Ramanathapuram	608	0	113	0	286	2	750	1	82	2	1196	0	3251	0	3229	0
27	Sivaganga	739	0	1294	1	1316	2	1356	0	1424	1	1440	0	1184	0	1427	0
28	Tirunelveli	878	1	0	0	172	1	37	0	251	1	4187	2	4951	1	5833	0
29	Tuticorin	1085	2	1178	0	1797	2	1361	2	656	2	1330	0	1529	0	1916	0
30	Kanyakumari	11	0	5	0	1500	1	5608	0	0	0	2887	0	1427	0	1172	0
31	Chennai	1683	0	2499	0	2211	2	2670	0	1150	0	31803	0	26121	0	20786	0
	Total	**52555**	**22**	**49920**	**26**	**60325**	**63**	**88746**	**21**	**62778**	**45**	**210074**	**24**	**199930**	**17**	**189288**	**24**

Source: Department of Public Health and Preventive Medicine, Govt of Tamil Nadu

Cholera

Cholera is caused due to Fecal Contamination of Water. Which predominantly arises from the passing of Untreated Sewage into the Water Bodies. From the tables below we find that the districts of Madurai and Chennai are found to contain the maximum No. of cases reported in the year 2012-2013

Table 2.41 District wise Cholera Cases and Deaths from 2003-2013

Sn no	Districts	2003		2004		2005	
		Cs	Ds	Cs	Ds	Cs	Ds
1	Kancheepuram	16	0	26	0	48	1
2	Tiruvellur	22	0	300	0	249	0
3	Cuddalore	1	0	2	0	2	0
4	Vilipuram	5	0	3	0	1	0
5	Vellore	8	0	35	2	5	0
6	T.v.malai	3	0	12	0	5	0
7	Dharmapuri	30	1	7	0	7	0
8	Salem	0	0	0	0	0	0
9	Namakkal	4	0	3	0	0	0
10	Erode	0	0	2	0	0	0
11	Coimbatore	0	0	2	0	0	0
12	The nilgiris	0	0	0	0	0	0
13	Tiruchi	0	0	4	0	3	0
14	Karur	0	0	0	0	0	0
15	Perambalur	1	0	0	0	0	0
16	Pudukotai	0	0	1	0	0	0
17	Thanjavur	0	0	1	0	0	0
18	Tiruvarur	0	0	0	0	0	0
19	Nagapattinam	0	0	0	0	0	0
20	Madurai	7	0	118	0	48	0
21	Theni	0	0	0	0	5	0
22	Dindugal	1	0	5	0	0	0
23	Virudunagar	0	0	4	0	1	0
24	Ramanathapuram	0	0	9	0	1	0
25	Sivaganga	1	0	13	0	18	0
26	Tirunelveli	8	0	0	0	5	0
27	Tuticorin	0	0	2	0	0	0
28	Kanyakumari	0	0	0	0	0	0
29	Chennai	283	0	956	0	379	0
	Total	**390**	**1**	**1505**	**2**	**777**	**1**

Cont. **Table 2.42 District wise Cholera Cases and Deaths from 2006-2013**

Sn No	Districts	2006		2007		2008		2009		2010		2011		2012		2013	
		Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds	Cs	Ds
1	Kancheepuram	19	0	86	0	35	0	25	0	18	0	45	0	2	0	18	0
2	Tiruvellur	32	0	190	0	353	0	153	0	97	0	0	0	0	0	6	0
3	Cuddalore	1	0	0	0	8	0	0	0	15	0	1	0	5	0	0	0
4	Vilipuram	0	0	2	0	2	0	3	0	20	0	3	0	0	0	2	0
5	Vellore	3	0	15	0	38	0	7	0	57	0	43	0	18	0	9	0
6	T.V.Malai	0	0	5	0	38	0	9	0	7	0	4	0	0	0	8	0
7	Dharmapuri	0	0	0	0	38	0	3	0	2	0	0	0	0	0	0	0
8	Krishnagiri	10	0	2	0	38	0	6	0	0	0	0	0	0	0	4	0
9	Salem	0	0	0	0	38	0	0	0	0	0	0	0	0	0	1	0
10	Namakkal	0	0	1	0	38	0	0	0	1	0	0	0	0	0	0	0
11	Erode	0	0	0	0	38	0	0	0	0	0	0	0	7	0	7	0
12	Coimbatore	1	0	0	0	38	0	0	0	0	0	0	0	1	0	0	0
13	Tiruppur	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0
14	The Nilgiris	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0
15	Tiruchi	21	0	16	0	38	0	3	0	40	0	0	0	3	0	12	0
16	Karur	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0
17	Perambalur	0	0	0	0	38	0	3	0	0	0	0	0	0	0	8	0
18	Pudukotai	0	0	0	0	38	0	0	0	0	0	0	0	0	0	3	0
19	Thanjavur	0	0	0	0	38	0	0	0	0	0	0	0	3	0	1	0
20	Tiruvarur	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0
21	Nagapattinam	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0
22	Madurai	1	0	22	0	38	0	148	0	221	0	148	0	266	0	6	0
23	Theni	0	0	0	0	38	0	0	0	33	1	6	0	1	0	0	0
24	Dindugal	0	0	0	0	38	0	6	0	11	0	4	0	3	0	0	0
25	Virudunagar	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0
26	Ramanathapuram	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0
27	Sivaganga	0	0	0	0	38	0	5	0	2	0	0	0	0	0	0	0
28	Tirunelveli	15	1	0	0	38	0	0	0	7	0	19	0	8	0	4	0
29	Tuticorin	0	0	0	0	38	0	0	0	0	0	2	0	0	0	0	0
30	Kanyakumari	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0
31	Chennai	49	0	386	0	38	0	445	0	401	0	305	0	206	0	57	0
	Total	**152**	**1**	**725**	**0**	38	**0**	**826**	**0**	**932**	**1**	**580**	**0**	**523**	**0**	**146**	**0**

Source : Department of Public Health and Preventive Medicine , Govt of Tamil Nadu

3. Air Pollution

Air pollution is defined as the introduction of particulates, biological molecules, or other harmful materials into the Earth's atmosphere, possibly that cause disease, death to humans, damage to food crops, or the natural or built environment. Stratospheric ozone depletion due to air pollution has long been recognized as a threat to human health as well as to the Earth's ecosystems. Indoor air pollution and urban air quality are listed as two of the world's worst toxic pollution problems**.**

3.1 Sources

There are various activities or factors which are responsible for releasing pollutants into the atmosphere.

These sources can be classified into two major categories.

-Anthropogenic (man-made) sources:

These are mostly due to the burning of multiple types of fuel.

Anthropogenic sources include the following:

Stationary sources include stacks of power plants, manufacturing factories, waste incinerators, furnaces and other types of fuel-burning devices.

In less developed countries traditional biomass burning is the major source of air pollutants; Traditional biomass includes wood, crop waste and cow-dung.

Mobile Sources include vehicles, marine vessels, and aircrafts. Fumes from paint, hair spray, varnish, aerosol sprays and other solvents also contribute towards air pollution. Waste deposition in landfills, generate methane during the breakdown of compounds. Methane being highly flammable and forms explosive mixtures with air. Methane is also an asphyxiant and displaces oxygen in an enclosed space.

Military resources, such as nuclear weapons and toxic gases are also key sources of air pollution.

Natural sources:

Dust from natural sources, mostly large areas of land with few or no vegetation. Radon gas from radioactive decay within the Earth's crust. Radon is a naturally occurring, radioactive noble gas that is formed from the decay of radium. It is considered to be a health hazard. Radon gas from natural

sources can accumulate in buildings, especially in confined areas is the one of the most frequent cause of lung cancer. Smoke and carbon monoxide from wildfires Volcanic activity, produces sulfur, chlorine, and ash particulates.A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary.

Primary pollutants are usually produced from a process, such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhaust, or the sulfur dioxide released from factories.

Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact. Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants.

In India the Major source of air pollution include Fuel wood and biomass burning in rural and urban India, Most of India uses Fuel wood and biomass cakes for cooking and general heating needs. Cook stoves using biomass are present in over 100 million Indian households, and are used two to three times a day. Majority of Indians still use traditional fuels such as dried cow dung, agricultural wastes, and firewood as cooking fuel

Major primary pollutants produced by human activity include:

Sulphur oxides (SOx) - particularly sulfur dioxide, a chemical compound with the formula SO2 is produced by volcanoes and various industrial processes. Coal and petroleum often contain sulfur compounds, and their combustion releases sulfur dioxide. Further oxidation of SO2, usually in the presence of a catalyst such as NO2, forms H2SO4, and leads to the formation of acid rain.

Nitrogen oxides (NOx)-Nitrogen oxides, particularly nitrogen dioxide, are expelled from high temperature combustion, and are also produced during thunderstorms by electric discharge. It is a chemical compound with the formula NO2. It is one of the most prominent air pollutants**.**

Carbon monoxide (CO)- CO is also a toxic gas. It is a product by incomplete combustion of fuel such as natural gas, coal or wood. Vehicular exhaust is a major source of carbon monoxide**.**

Volatile organic compounds - VOCs are a well-known outdoor air pollutant**.** They are categorized as either methane (CH4) or non-methane (NMVOCs). Methane is a greenhouse gas which has contributed to enhance global warming. The aromatic NMVOCs such as benzene, toluene and xylene are suspected carcinogens and may lead to leukemia with prolonged exposure.

1,3-butadiene is another compound often associated with industrial use.

Particulate Matter

Particulates, alternatively referred to as particulate matter (PM), atmospheric particulate matter, or fine particles, are particles of solid or liquid suspended in a gas.

Aerosols

In contrast, aerosol refers to combined particles and gas. They can occur naturally, from volcanoes, dust storms, forest fires, and sea spray. Human activities, such as the burning of fossil fuels in vehicles, power plants and industrial processes also generate significant amounts of aerosols.

Chlorofluorocarbons (CFCs) - harmful to the ozone layer. These are gases which are released from air conditioners, refrigerators. CFC's on being released into the air rises to stratosphere and react with other gases and damage the ozone layer. This allows harmful ultraviolet rays to reach the earth's surface causing skin cancer and diseases to the eye.

Secondary pollutants include:

Particulates created from gaseous primary pollutants are called secondary pollutants. Smog is a kind of secondary air pollution. Smog results from large amounts of coal burning in an area caused by a mixture of smoke and sulfur dioxide. Smog also comes from vehicular and industrial emissions that are acted on in the atmosphere by ultraviolet light from the sun to form secondary pollutants that also combine with the primary emissions to form photochemical smog.

Ground level ozone (O3) is formed from NOx and VOCs. Ozone (O3) is a key constituent of the troposphere. It is also an important constituent of certain regions of the stratosphere commonly known as the Ozone layer.

Peroxyacetyl nitrate (PAN) – is also formed from NOx and VOCs.

3.2 Status Of Air Quality Of Important Cities /Towns Of Tamil Nadu

Table 3.1 Status Of Air Quality Of Important Cities /Towns Of Tamilnadu-Under National Air Quality Monitoring Programme(Namp) Annual Average Concentration Of Air Pollutants,2004-2005

SI. No	CITY & LOCATION	CATEGORY	Annual Average Concentration of Air Pollutants in µg/m^3											
			SO_2			NOx			TSPM			RSPM		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1	**CHENNAI**													
a)	Kathivakkam	Industrial	44	5	19	60	14	32	273	54	128	135	37	73
b)	Manali	Industrial	48	7	20	80	14	34	365	77	181	165	40	95
c)	Thirvottiyur	Mixed	38	6	19	54	12	31	494	56	133	279	36	85
2	**COIMBATORE**													
a)	DCO	Mixed	15	4	7	65	25	39	314	36	134	140	19	53
b)	Pooniyarajapuram	Residential	18	4	7	86	20	41	423	33	113	361	19	51
c)	SIDCO	Industrial	29	4	9	90	11	48	552	42	192	159	28	84
3	**THOOTHUKUDI**													
a)	Raja Agencies	Industrial	57	13	20	59	9	17	137	14	62	96	9	39
b)	AVM Buildings	Mixed	41	13	19	54	9	18	421	19	71	103	14	46
c)	Fisheries college	Industrial	56	12	19	89	9	18	118	18	60	83	14	38
4	**MADURAI**													
a)	Fenner India ltd Building	Industrial	55	8	18	54	12	28	277	64	136	44	22	52
b)	Kannathur chathiram	Mixed	17	5	9	48	11	22	1243	106	355	1038	70	177
c)	Highways project Buildings	Residential	19	5	9	44	11	30	389	33	109	224	15	51
5	**SALEM**													
	Sowdeswari College Building	Mixed	10	5	7	77	12	34	173	33	71	89	16	38
	Prescribed Standard													
	i)Industrial		80			80			360			120		
	II)Residential,Rural & other areas(mixed)		60			60			140			60		

Source: TNPCB Year book , 2004-2005

Table 3.2 Status Of Air Quality Of Important Cities /Towns Of Tamilnadu-Under National Air Quality Monitoring Programme(Namp)
Annual Average Concentration Of Air Pollutants,2005-2006

SI. No	CITY & LOCATION	CATEGORY	Annual Average Concentration of Air Pollutants in µg/m^3											
			SO_2			NO_X			TSPM			RSPM		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1	**CHENNAI**													
a)	Kathivakkam	Industrial	36	4	13	45	14	25	589	64	221	120	22	71
b)	Manali	Industrial	42	4	14	57	11	27	577	65	236	188	22	79
c)	Thirvottiyur	Industrial	45	4	13	46	9	28	651	39	207	142	15	70
2	**COIMBATORE**													
a)	DCO	Mixed	18	4	8	62	21	43	250	27	90	96	14	39
b)	Poniyarajapuram	Residential	14	4	7	57	19	38	209	30	86	108	10	44
C)	SIDCO	Industrial	25	4	10	69	31	47	382	45	161	160	25	73
3	**THOOTHUKUDI**													
a)	Raja Agencies	Industrial	43	11	19	71	8	20	252	19	81	232	15	61
b)	AVM Buildings	Mixed	36	11	19	62	8	20	291	22	105	202	10	83
C)	Fisheries college	Industrial	31	11	19	71	7	22	220	16	66	209	13	54
4	**MADURAI**													
a)	Fennar Building	Industrial	28	6	17	70	11	29	370	15	117	120	7	37
b)	Kunnathur chatiram	Mixed	26	5	10	83	10	28	460	52	208	185	18	57
C)	Highways project Buildings	Residential	19	6	9	69	9	27	280	36	110	121	9	37
5	**SALEM**													
	Sowdeswari College Building	Mixed	11	5	7	69	16	33	122	20	69	82	18	42
	Prescribed Standard:													
	i)Industrial	80			80			360			120			
	II)Residential,Rural &other areas	60			60			140			60			

Source: TNPCB Year book , 2005-2006

Table 3.3 Status Of Air Quality Of Important Cities/ Towns Of Tamilnadu Under National Air Quality Monitoring Programme (Namp)
Annual Average Concentration Of Air Pollutants 2006-2007

Sl.No	City and Location	Category	Annual Average Concentrations of Air Pollutants in µg/m^3											
			SO_2			NOx			TSPM			RSPM		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1	CHENNAI													
a)	Kathivakkam	Industrial	31	4	14	54	11	25	392	40	140	120	27	61
b)	Manali	Industrial	28	5	14	44	6	25	332	62	151	225	34	81
c)	Thiruvottiyur	Mixed	25	4	14	41	11	24	240	39	128	155	21	66
2	COIMBATORE													
a)	DCO	Mixed	20	4	10	49	15	32	216	19	88	131	16	44
b)	Pooniyarajapuram	Residential	17	4	9	48	17	32	249	24	87	100	12	44
c)	SIDCO	Industrial	26	4	11	63	17	40	866	80	230	225	45	102
3	THOOTHUKUDI													
a)	Raja Agencies	Industrial	69	7	18	81	5	17	467	30	125	298	20	90
b)	AVM Building	Mixed	58	9	18	52	5	18	452	34	116	310	25	78
c)	Fisheries College	Industrial	37	7	17	52	7	17	358	39	90	240	23	63
4	MADURAI													
a)	M/s. Susee Cars & Trucks (P) Ltd	Industrial	24	7	12	57	13	26	190	35	94	96	28	65
b)	Avvai Girls Hr.Sec.School	Mixed	25	6	10	41	14	23	266	22	103	194	10	34
c)	Highways Project Building	Residential	24	6	9	40	13	23	226	16	98	95	9	37
5	SALEM													
a)	Sowdeswari College	Mixed	11	5	7	69	16	33	122	20	69	82	18	42
Prescribed Standard														
i) Industrial					80			80			360			120
ii) Residential, Rural & Other Areas (Mixed)					60			60			140			60

Source: TNPCB Year book , 2006-2007

Table 3.4 Status Of Air Quality Of Important Cities /Towns Of Tamilnadu-Under National Air Quality Monitoring Programme(Namp), Annual Average Concentration Of Air Pollutants,2008-2009

SI.No	CITY & LOCATION	CATEGORY	Annual Average Concentration of Air Pollutants in µg/m^3											
			SO_2			NO_X			TSPM			RSPM		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1	**CHENNAI**													
a)	**Kathivakkam**	**Industrial**	16	11	13	21	16	19	305	147	196	103	54	78
b)	**Manali**	**Industrial**	18	12	14	25	18	21	252	106	177	150	45	86
c)	**Thirvottiyur**	**Industrial**	15	11	13	22	16	20	293	110	196	168	50	100
2	**COIMBATORE**													
a)	**G.D Matric school**	**Mixed**	7	4	5	38	19	30	183	56	107	91	28	59
b)	**Pooniyarajapuram**	**Residential**	7	4	5	44	17	31	156	44	90	80	20	50
C)	**SIDCO**	**Industrial**	8	5	6	49	25	37	332	141	221	193	85	116
3	**THOOTHUKUDI**													
a)	**Raja Agencies**	**Industrial**	35	15	27	33	8	19	454	147	281	223	97	**166**
b)	**AVM Buildings**	**Mixed**	48	22	30	33	10	17	217	115	152	185	79	**99**
c)	**SIPCOT**	**Industrial**	41	22	30	66	12	19	269	83	130	192	60	**86**
4	**MADURAI**													
a)	**M/S Susee Cars & Trucks (p) Ltd.,**	**Industrial**	12	9	11	26	20	24	116	66	91	67	29	45
b)	**Awai Girls Higher Secondary School**	**Mixed**	11	8	10	28	21	24	109	41	87	94	27	49
C)	**Highways project Buildings**	**Residential**	11	9	10	26	21	24	111	64	84	67	29	41
5	**SALEM**													
	Sowdeswari College	**Mixed**	9	8	9	26	23	25	159	83	118	104	53	79
	Prescribed Standard:													
	i)Industrial		**80**			**80**			**360**			**120**		
	II)Residential,Rural		**60**			**60**			**140**			**60**		

Source: TNPCB Year book , 2008-2009

Table 3.5 Status Of Air Quality Of Important Cities /Towns Of Tamilnadu-Under National Air Quality Monitoring Programme(Namp) Annual Average Concentration Of Air Pollutants,2009-2010

SI. NO	CITY & LOCATION	CATEGORY	Annual Average Concentration of Air Pollutants in µg/m^3											
			SO_2			NO_X			TSPM			RSPM		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1	CHENNAI													
a)	Kathivakkam	Industrial	19	8	12	31	11	19	340	87	181	184	35	78
b)	Manali	Industrial	22	8	13	27	12	20	375	50	174	223	32	83
c)	Thirvottiyur	Industrial	26	9	15	38	11	22	706	94	218	406	40	108
2	COIMBATORE													
a)	G.D Matric school	Mixed	18	4	5	56	10	23	540	39	121	273	23	60
b)	Pooniyarajapuram	Residential	16	4	5	50	10	23	236	33	98	153	11	51
C)	SIDCO	Industrial	29	4	7	60	10	27	955	98	231	216	51	100
3	THOOTHUKUDI													
a)	Raja Agencies	Industrial	38	4	15	31	5	12	670	52	254	360	20	135
b)	AVM Buildings	Mixed	45	4	15	32	5	13	297	24	97	146	12	47
C)	SIPCOT	Industrial	47	4	17	36	4	11	368	40	138	146	21	70
4	MADURAI													
a)	M/S Susee Cars & Trucks (p) Ltd.,	Industrial	15	7	11	34	18	25	129	47	81	70	16	36
b)	Awai Girls Higher Secondary School	Mixed	19	7	10	32	17	24	267	54	104	136	49	76
C)	Highways project Buildings	Residential	15	7	10	33	18	25	227	44	97	125	24	46
5	SALEM													
	Sowdeswari College Building	Mixed	14	6	9	41	16	24	267	56	133	167	32	85
	Prescribed Standard:													
	i)Industrial	80			80			360			120			
	II)Residential,Rural	60			60			140			60			

Source: TNPCB Year book , 2009-2010

Table 3.6 Status Of Air Quality Of Important Cities /Towns Of Tamilnadu-Under National Air Quality Monitoring Programme (Namp) Annual Average Concentration Of Air Pollutants,2010-2011

S.	CITY & LOCATION	CATEGORY	Annual Average Concentration of Air Pollutants in µg/m^3

NO			SO2			NOX			TSPM			RSPM		
			Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
1	CHENNAI													
a)	Kathivakkam	Industrial	36	9	12	32	12	18	353	62	179	219	29	88
b)	Manali	Industrial	58	9	12	40	12	20	407	46	165	246	38	87
c)	Thirvottiyur	Industrial	17	8	12	28	12	20	585	77	167	292	30	66
2	COIMBATORE													
a)	G.D Matric school	Mixed	49	4	6	46	13	24	506	34	157	250	15	60
b)	Pooniyarajapuram	Residential	34	4	5	39	9	21	463	21	111	190	10	56
C)	SIDCO	Industrial	43	4	6	264	12	34	1403	39	273	1184	12	102
3	THOOTHUKUDI													
a)	Raja Agencies	Industrial	88	4	12	35	6	14	764	79	310	385	50	178
b)	AVM Buildings	Mixed	48	4	10	46	7	14	389	23	90	198	13	53
C)	SIPCOT	Industrial	36	4	12	28	7	12	589	38	156	347	17	88
4	MADURAI													
a)	M/S Susee Cars & Trucks (p) Ltd.,	Industrial	19	7	11	42	16	25	166	60	111	82	22	42
b)	Awai Girls Higher Secondary School	Mixed	15	7	8	34	15	25	207	25	107	88	25	45
C)	Highways project Buildings	Residential	17	5	11	33	12	24	222	52	101	101	23	47
5	SALEM													
	Sowdeswari College Building	Mixed	12	5	9	59	13	24	228	30	111	157	28	74
	Prescribed Standard:													

	SO2	NOX	TSPM	RSPM
i)Industrial	80	80	360	120
II)Residential, Rural & other areas	60	60	140	60

Source: TNPCB Year book , 2010-2011

Table 3.7 Status Of Air Quality Of Important Cities/Towns Of Tamilnadu – Under National Air Quality Monitoring Programme (Namp) Annual Average Concentrations Of Air Pollutants, 2011 – 2012

S.NO	City & Location	Category	Annual Average concentrations of Air Pollutants in µg/m^3

			SO_2			NO_2			RSPM		
			Max	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**Avg**
1	**CHENNAI**										
a)	**Kathivakkam**	**Industrial**	48	10	22	64	13	27	363	39	132
b)	**Manali**	**Industrial**	46	9	20	68	11	26	152	26	70
c)	**Thirvottiyur**	**Industrial**	42	8	20	61	12	27	351	22	88
2	**COIMBATORE**										
a)	**G.D Matric school**	**Mixed**	9	4	5	73	13	30	218	19	68
b)	**Pooniyarajapuram**	**Residential**	13	4	5	76	13	29	273	11	68
C)	**SIDCO**	**Industrial**	8	4	5	111	9	35	443	20	205
3	**THOOTHUKUDI**										
a)	**Raja Agencies**	**Industrial**	29	4	7	35	9	13	601	51	132
b)	**AVM Buildings**	**Mixed**	48	4	7	46	9	14	215	17	81
C)	**SIPCOT**	**Industrial**	23	4	9	34	9	15	437	26	112
4	**MADURAI**										
a)	**M/S Susee Cars & Trucks (p) Ltd.,**	**Industrial**	15	7	10	29	18	23	63	18	44
b)	**Awai Girls Higher Secondary School**	**Mixed**	22	5	11	43	16	24	137	26	46
C)	**Highways project Buildings**	**Residential**	17	6	10	27	16	24	89	28	47
5	**SALEM**										
a)	**Sowdeswari College Building**	**Mixed**	13	6	8	31	13	21	134	28	62
	Prescribed Standard:										
		SO2	**NOX**			**TSPM**			**RSPM**		
i)Industrial		**80**	**80**			**360**			**120**		
II)Residential, Rural &other areas		**60**	**60**			**140**			**60**		

Source: TNPCB Year book , 2011-2012

Table 3.8 Chennai Ambient Air Quality Monitoring Programme Status Of Air Quality During April 2004 To March 2005

SI.NO	STATION	ANNUAL AVERAGE CONCENTRATION OF AIR POLLTANTS µg/m^3			
		SO_2	NO_X	RSPM	TSPM
1	ANNA NAGAR	6	20	68	158
2	ADYAR	5	14	33	71
3	KILPAUK	7	36	97	308
4	THIYAGARAYANAGAR	8	30	77	197
5	VALLALAR NAGAR	8	33	87	255
	Prescribed standard	60	60	60	140

Source: TNPCB Year book , 2004-2005

Table 3.9 Chennai Ambient Air Quality Monitoring Programme Status Of Air Quality During April 2005 To March 2006

SI.NO	STATION	ANNUAL AVERAGE CONCENTRATION OF AIR POLLTANTS µg/m3			
		SO_2	NO_X	RSPM	TSPM
1	ANNA NAGAR	6	26	75	183
2	ADAYAR	5	20	46	102
3	KILPAUK	8	39	92	267
4	THIYAGARAYA NAGAR	8	37	81	209
5	VALLALAR NAGAR	8	36	83	232
	PRESCRIBED STANDARDS	60	60	60	140

Source: TNPCB Year book , 2005-2006

Table 3.10 Chennai Ambient Air Quality Monitoring Programme Status Of Air Quality Monitoring During 2006-2007

Sl.No.	Station	Average Concentrations of Air Pollutants, µg/m^3			
		SO_2	NOx	RSPM	TSPM
1	ANNA NAGAR	8	22	63	146
2	ADAYAR	7	17	41	90
3	KILPAUK	9	27	91	211
4	THIYAGARAYANAGAR	10	27	83	218
5	VALLALAR NAGAR	10	33	92	249
Prescribed Standard		60	60	60	140

Source: TNPCB Year book , 2006-2007

Table 3.11 Chennai Ambient Air Quality Monitoring Programme Status Of Air Quality During April 2008 To March 2009

SI.No	STATION	ANNUAL AVERAGE CONCENTRATION OF AIR POLLTANTS, µg/m^3			
		SO2	NOX	RSPM	TSPM
1	ANNA NAGAR	10	25	121	262
2	ADYAR	7	12	50	97
3	KILPAUK	11	28	98	231
4	THIYAGARAYANAGAR	11	29	129	278
5	VALLALAR NAGAR	12	28	140	359
Prescribed standard		60	60	60	140

Source: TNPCB Year book , 2008-2009

Table 3.12 Chennai Ambient Air Quality Monitoring Programme Status of Air Quality During April 2009 To March 2010

SI.No	STATION	ANNUAL AVERAGE CONCENTRATION OF AIR POLLTANTS µg/m3			
		SO_2	NO_X	RSPM	TSPM
1	ANNA NAGAR	9	22	92	207
2	ADAYAR	8	16	40	78
3	KILPAUK	10	32	110	240
4	THIYAGARAYA NAGAR	12	30	143	285
5	VALLALAR NAGAR	12	35	136	315
PRESCRIBED STANDARDS		60	60	60	140

Source: TNPCB Year book , 2009-2010

Table 3.13 Chennai Ambient Air Quality Monitoring Programme Status Of Air Quality During April 2010 To March 2011

S.NO	STATION	ANNUAL AVERAGE CONCENTRATION OF AIR POLLTANTS µg/m^3		
		SO_2	NO_X	RSPM
1	**ANNA NAGAR**	**8**	**21**	**98**
2	**ADYAR**	**8**	**15**	**34**
3	**KILPAUK**	**10**	**28**	**91**
4	**THIYAGARAYANAGAR**	**11**	**30**	**119**
5	**VALLALAR NAGAR**	**11**	**29**	**135**
Prescribed standard		**60**	**60**	**60**

Source: TNPCB Year book , 2010-2011

Table 3.14 Chennai Ambient Air Quality Monitoring Programme

STATION	ANNUAL AVERAGE CONCENTRATION OF AIR POLLTANTS µg/m^3		
	SO_2	**NO_2**	**RSPM**
ANNA NAGAR	9	18	136
ADYAR	8	12	63
KILPAUK	10	20	135
THIYAGARAYANAGAR	11	21	145
VALLALAR NAGAR	11	21	168
Prescribed Standard	**50**	**40**	**60**

Source: TNPCB Year book , 2011-2012

Table 3.15 Status Report Of Trichy Air Quality Under Trichy Ambient Air Quality Monitoring Programme (Taaqm) During 2004-2005

Sl.No	Station	Average Concentrations of Air Pollutants, micro gram /m^3			
		SO_2	NO_X	RSPM	TSPM
1	Gandhi Market	15	19	90	208
2	Mainguard Gate	15	19	84	197
3	Bishop Heber College	11	15	53	72
4	Golden Rock	12	15	62	87
5	Central Bus Stand , Trichy	15	18	81	180
Prescribed Standard		**60**	**60**	**60**	**140**

Source: TNPCB Year book , 2004-2005

Table 3.16 Status Report Of Trichy Air Quality Under Trichy Ambient Air Quality Monitoring Programme (Taaqm) During 2005-2006

SI.NO	STATION	AVERAGE CONCENTRATIONS OF AIR POLLUTANTS µg/m3			
		SO_2	NOx	RSPM	TSPM
1	Gandhi Market	16	19	80	180
2	Mainguard Gate	16	20	83	185
3	Bishop Heber College	11	13	50	70
4	Golden Rock	12	15	58	81
5	Central Bus Stand , Trichy	15	19	71	153
Prescribed Standard		60	60	60	140

Source: TNPCB Year book , 2005-2006

Table 3.17 Status Report Of Trichy Air Quality Under Trichy Ambient Air Quality Monitoring Programme (Taaqm) During

2006 - 2007

Sl.No.	Station	Average Concentrations of Air Pollutants, µg/m^3			
		SO_2	NOx	RSPM	TSPM
1	Gandhi Market	17	23	73	223
2	Mainguard Gate	15	20	77	250
3	Bishop Heber College	11	17	48	119
4	Golden Rock	11	16	42	108
5	Central Bus Stand, Trichy	18	23	105	227
Prescribed Standard		60	60	60	140

Source: TNPCB Year book , 2006-2007

Table 3.18 Status Report Of Trichy Air Quality Under Trichy Ambient Air Quality

Monitoring Programmr (Taaqm) During 2008-2009

Sl.No	Station	Average Concentrations of Air Pollutants, µg/m^3			
		SO2	NOX	RSPM	TSPM
1	Gandhi Market	20	25	95	251
2	Mainguard Gate	20	25	80	222
3	Bishop Heber College	10	14	36	73
4	Golden Rock	11	15	39	102
5	Central Bus Stand , Trichy	19	24	103	228
Prescribed Standard		60	60	60	140

Source: TNPCB Year book , 2008-2009

Table 3.19 Status Report Of Trichy Air Quality Under Trichy Ambient Air Quality

Monitoring Programme (Taaqm) During 2009-2010

SI.NO	STATION	AVERAGE CONCENTRATIONS OF AIR POLLUTANTS µg/m3			
		SO_2	NOx	RSPM	TSPM
1	Gandhi Market	16	22	105	220
2	Mainguard Gate	15	22	96	226
3	Bishop Heber College	9	13	38	98
4	Golden Rock	9	14	37	99
5	Central Bus Stand , Trichy	17	24	137	256
Prescribed Standard		60	60	60	140

Source: TNPCB Year book , 2009-2010

Table3.20 Status Report Of Trichy Air Quality Under Trichy Ambient Air Quality Monitoring Programme (Taaqm) During 2010-2011

S.No	Station	Average Concentrations of Air Pollutants, µg/m^3			
		SO_2	NO_X	RSPM	TSPM
1	Gandhi Market	14	21	100	223
2	Mainguard Gate	13	19	69	183
3	Bishop Heber College	9	13	36	92
4	Golden Rock	10	15	35	87
5	Central Bus Stand , Trichy	20	22	92	219
Prescribed Standard		60	60	60	140

Source: TNPCB Year book , 2010-2011

Table 3.21 Status Report Of Trichy Air Quality Under Trichy Ambient Air Quality Monitoring Programmr (Taaqm) During 2011 – 2012

S.No	Station	Average Concentration of Air Polltants, µg/m^3		
		SO_2	NO_2	RSPM
1	Gandhi Market	12	17	92
2	Mainguard Gate	11	17	68
3	Bishop Heber College	9	14	40
4	Golden Rock	10	15	42
5	Central Bus Stand, Trichy	13	19	113
Prescribed Standard		**50**	**40**	**60**

Source: TNPCB Year book , 2011-2012

Table 3.22 Status Of Vehicle Tested At Tnpcb Vem Stations During 2004-2005

SI.No	STATION	NO. OF VEHICLES TESTED	VEHICLES WITHIN THE LIMIT	VEHICLES EXCEEDED THE LIMIT DURING FIRST TEST	VEHICLES COMPLIED EMISSION STANDARD AFTER RECTIFICATION	VEHICLES NOT COMPLIED EMISSION STANDARD	% OF VEHICLE EXCEEDED THE LIMIT DURING FIRST TEST
1	Chennai City	34553	28138	6475	4944	1531	19
2	Udhagamandalam	5247	4275	972	834	138	19
3	Dindigul	2303	2195	108	40	68	5
4	Palani	3783	3204	579	543	36	15
5	Chengalpattu	5454	3637	1817	1606	211	33
6	Katteri	2827	2141	686	610	76	24
Grand Total		**54167**	**43590**	**10637**	**8577**	**2060**	**20**

Source: TNPCB Year book , 2004-2005

Table 3.23 Status Of Vehicle Tested At Tnpcb Vem Stations During 2005-2006

SI.NO	STATION	NO. OF VEHICLES TESTED	VEHICLES WITHIN THE LIMIT	VEHICLES EXCEEDED THE LIMIT DURING FIRST TEST	VEHICLES COMPLIED EMISSION STANDARD AFTER RECTIFICATION	VEHICLES NOT COMPLIED EMISSION STANDARD	% OF VEHICLE EXCEEDED THE LIMIT DURING FIRST TEST
1	Chennai	32,200	29,892	2,308	1,626	682	7.17
2	VEM stations other than Chennai city	5,147	4,647	500	394	106	9.70
Grand Total		37,347	34,539	2,808	2,020	788	7.52

*The TNPCB VEM stations other than Chennai city denote the stations at Udagamandalam, Katteri, Dindigul,Palani & Chengalpattu. The above stations were closed with effect from 16.11.2005 and emission check is being carried out by authorized private vehicle emission testing centres in the above places.

Table 3.24 Status Of Vehicle Tested At Tnpcb Vem Station During 2006-2007

Sl.No	Station	No. of Vehicles tested	Vehicles within the limit	Vehicles exceeded the limit during the first test	Vehicles complied emission standard after rectification	Vehicles not complied emission standard	% of vehicle exceeded the limit during the first test
1	Chennai City	35,370	32,670	2,700	1,943	757	7.63

Table 2.25 Status Of Vehicle Tested At Tnpcb Vem Stations During 2008-2009

Si.No	Station	No. Of Vehicles Tested	Vehicles Within The Limit	Vehicles Exceeded The Limit During First Test	Vehicles Complied Emission Standard After Rectification	Vehicles Not Complied Emission Standard	% Of Vehicle Exceeded The Limit During First Test
1	Chennai City	42,206	40,835	4,760	3,389	1371	11.28

Table 3.26 Status Of Vehicle Tested At Tnpcb Vem Stations During 2009-2010

Si.No	Station	No. Of Vehicles Tested	Vehicles Within The Limit	Vehicles Exceeded The Limit During First Test	Vehicles Complied Emission Standard After Rectification	Vehicles Not Complied Emission Standard	% Of Vehicle Exceeded The Limit During First Test
1	Chennai	22,012	21,504	1,668	1,160	508	7.58%

Table 3.27 Status Of Vehicle Tested At Tnpcb Vem Station During 2010-2011

Sl.No	Station	No. of Vehicles tested	Vehicles within the limit	Vehicles exceeded the limit during the first test	Vehicles complied emission standard after rectification	Vehicles not complied emission standard	% of vehicle exceeded the limit during the first test
1	Chennai City	1,142	1,117	27	2	25	2.36 %

All data Sources are from TNPCB Year Books

Table 3.28 Ambient Air Quality Monitoring Results of Chennai between 2003 &2012				
a. Location: Municipal Kalyanamandapam, Kathivakkam, Chennai				
Category -Industrial Area				
Year	Annual Average Concentration of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	163	90	32	24
2004-2005	128	73	32	19
2005-2006	221	71	25	13
2006-2007	140	61	25	14
2008-2009	196	78	19	13
2009-2010	181	78	19	12
2010-2011	179	88	18	12
2011-2012	NA	132	27	22
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

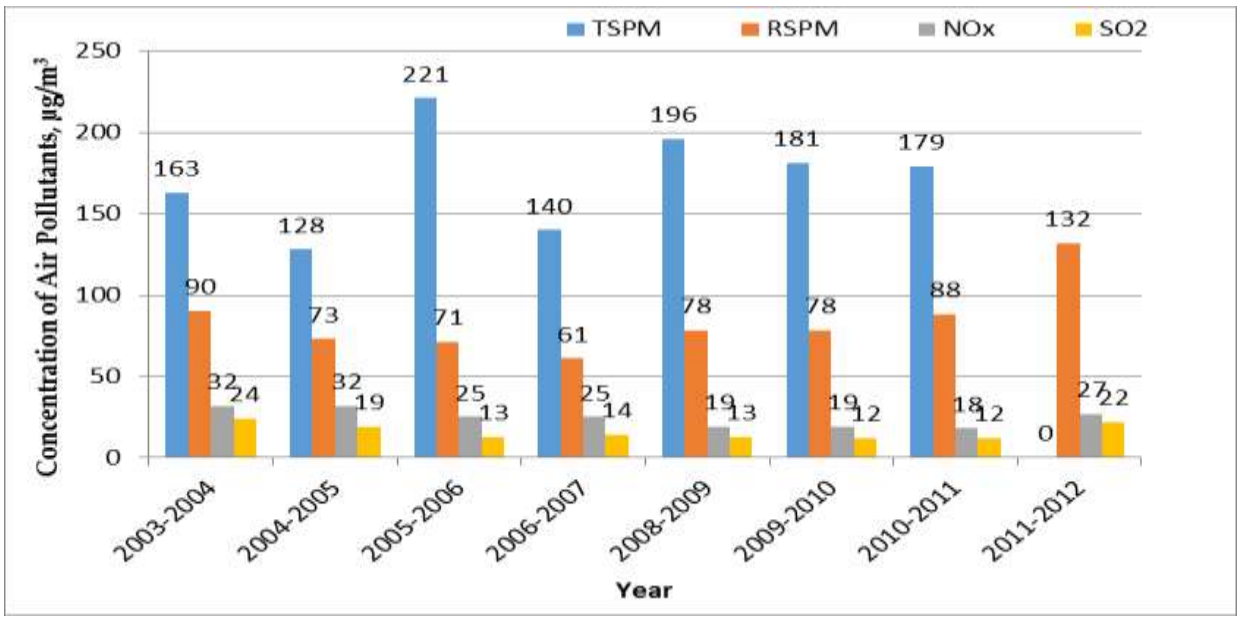


Figure. 3.1 Graph showing Ambient Air Quality in Kathivakkam Chennai between 2003-2012

Table 3.29 Ambient Air Quality Monitoring Results of Chennai between 2003 &2012				
b.Govt. Hr.Sec, School, Manali, Chennai				
Category -Industrial Area				
Year	Annual Average Concentation of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	214	109	34	22
2004-2005	181	95	34	20
2005-2006	236	79	27	14
2006-2007	151	81	25	14
2008-2009	177	86	21	14
2009-2010	174	83	20	13
2010-2011	165	87	20	12
2011-2012	NA	70	26	20
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

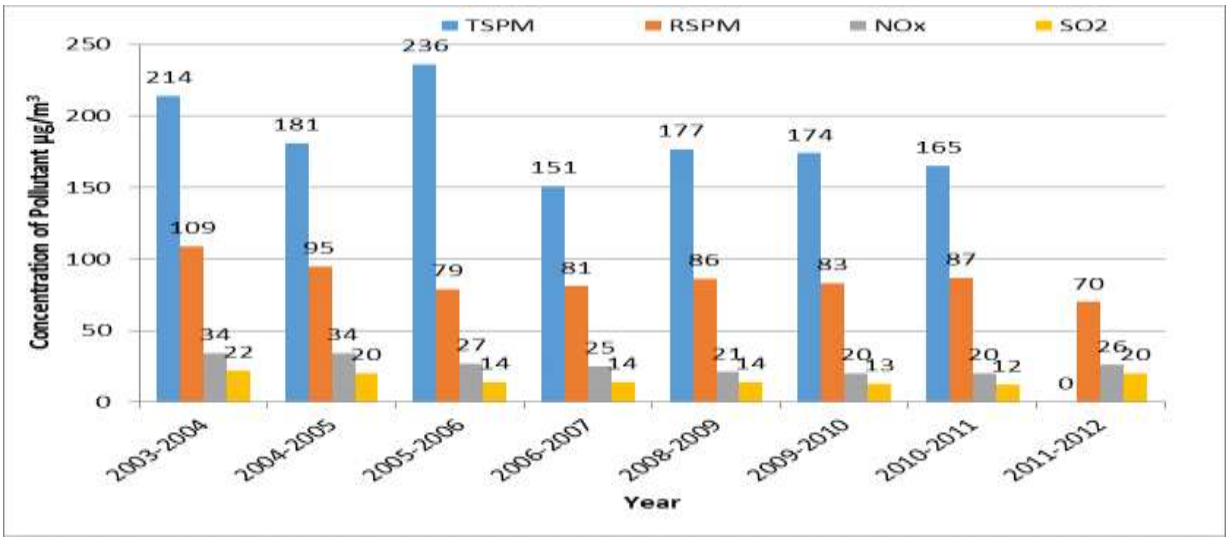


Figure. 3.2 Graph showing Ambient Air Quality in Manali Chennai between 2003-2012

Table 3.30 Ambient Air Quality Monitoring Results of Chennai between 2003 &2012 c.Municipal Office , Thiruvottiyur, Chennai				
Category -mixed Area				
Year	Annual Average Concentation of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	151	95	32	20
2004-2005	133	85	31	19
2005-2006	207	70	28	13
2006-2007	128	66	24	14
2008-2009	196	100	20	13
2009-2010	218	108	22	15
2010-2011	167	66	20	12
2011-2012	NA	88	27	20
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

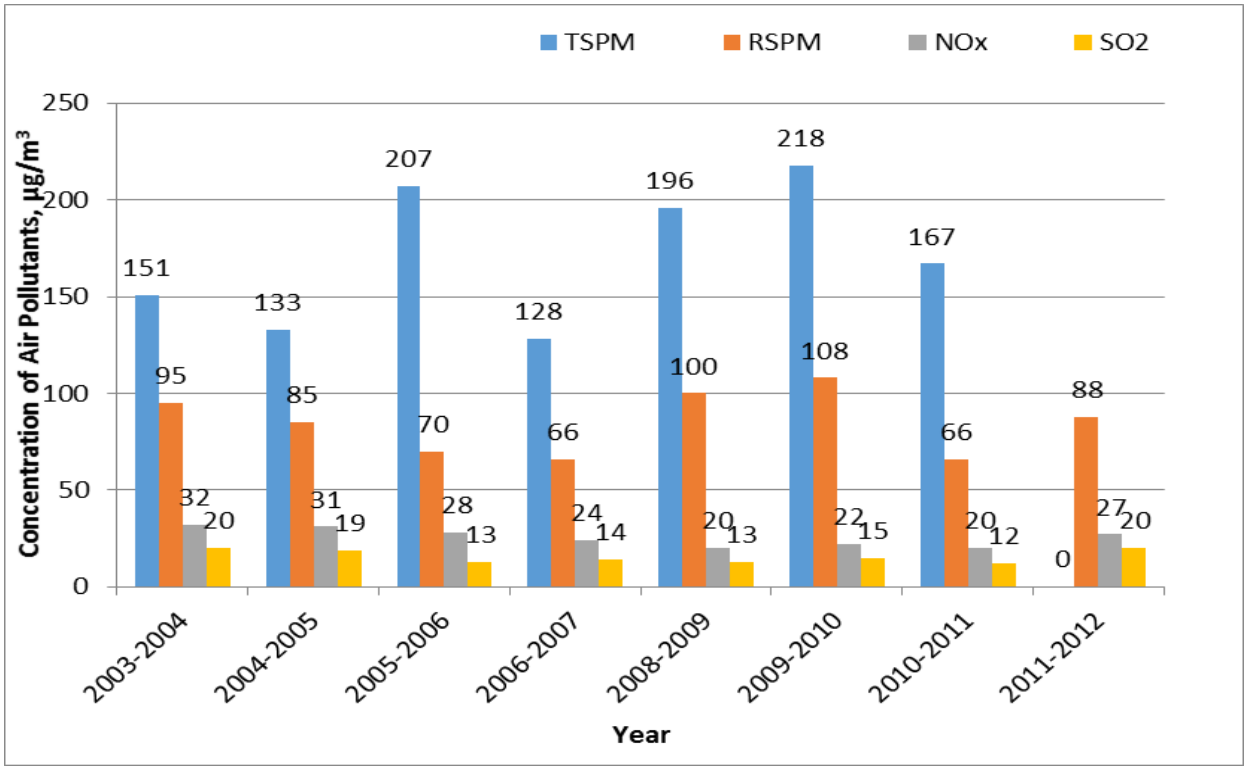


Figure. 3.3 Graph showing Ambient Air Quality in , Thiruvottiyur Chennai between 2003-2012

Table 3.31 Ambient Air Quality Monitoring Results of Coimbatore between 2003&2012				
a. Location: Collectorate Office Building/GD Matric School, Coimbatore				
Category -Mixed Area				
Year	Annual Average Concentration of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	108	43	51	10
2004-2005	134	53	39	7
2005-2006	90	39	43	8
2006-2007	88	44	32	10
2008-2009	107	59	30	5
2009-2010	121	60	23	5
2010-2011	157	60	24	6
2011-2012	NA	68	30	5
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

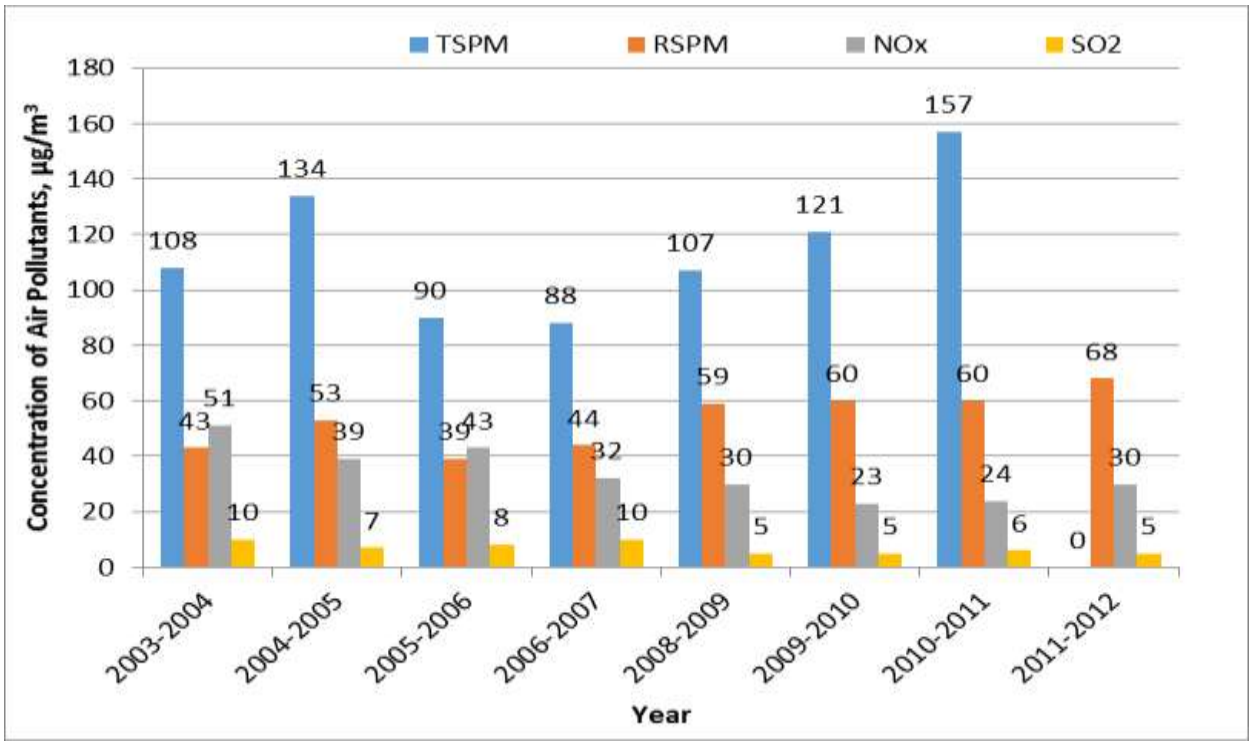


Figure. 3.4 Graph showing Ambient Air Quality in GD, School Coimbatore between 2003-2012

Table 3.32 Ambient Air Quality Monitoring Results of Coimbatore between 2003 &2012				
b. Location: Ponniyarajapuram, Coimbatore				
Category -Residential Area				
Year	Annual Average Concentration of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	111	46	46	10
2004-2005	113	51	41	7
2005-2006	86	44	38	7
2006-2007	87	44	32	9
2008-2009	90	50	31	5
2009-2010	98	51	23	5
2010-2011	111	56	21	5
2011-2012	NA	68	29	5
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

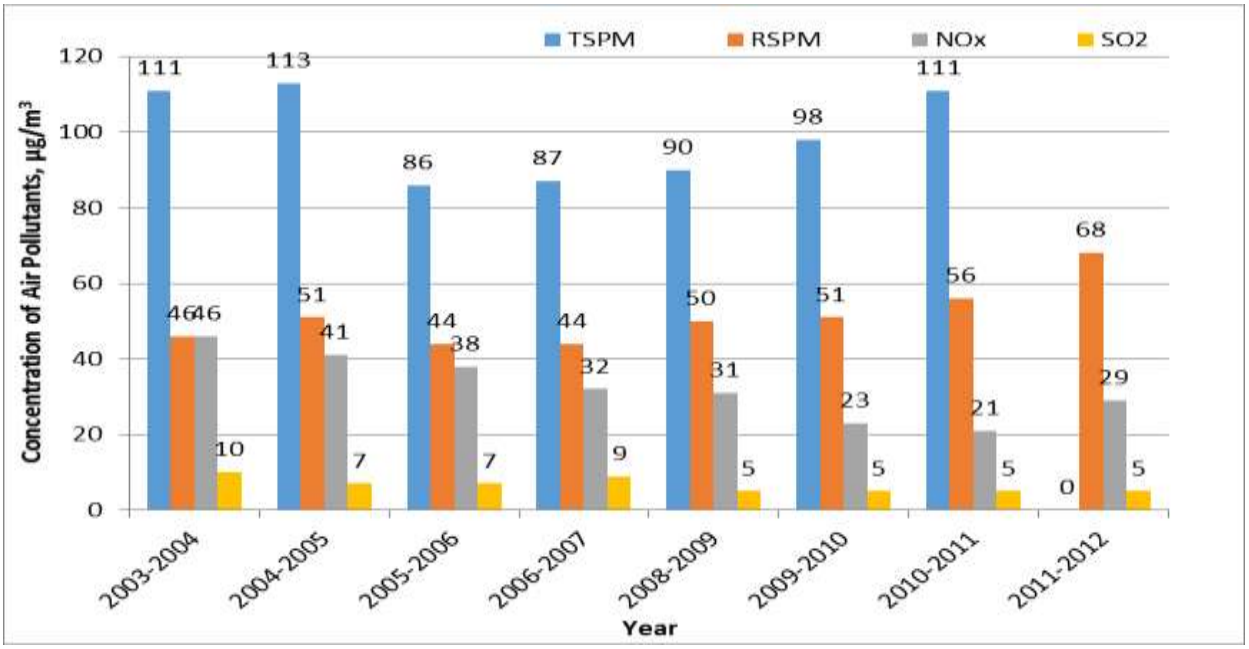


Figure. 3.5 Graph showing Ambient Air Quality in Ponniyarajapuram Coimbatore between 2003-2012

Table 3.33 Ambient Air Quality Monitoring Results of Coimbatore between 2003 &2012				
c. Location: SIDCO, Coimbatore				
Category -Industrial Area				
Year	Annual Average Concentation of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	151	62	56	13
2004-2005	192	84	48	9
2005-2006	161	73	47	10
2006-2007	230	102	40	11
2008-2009	221	116	37	6
2009-2010	231	100	27	7
2010-2011	273	102	34	6
2011-2012	NA	205	35	5
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

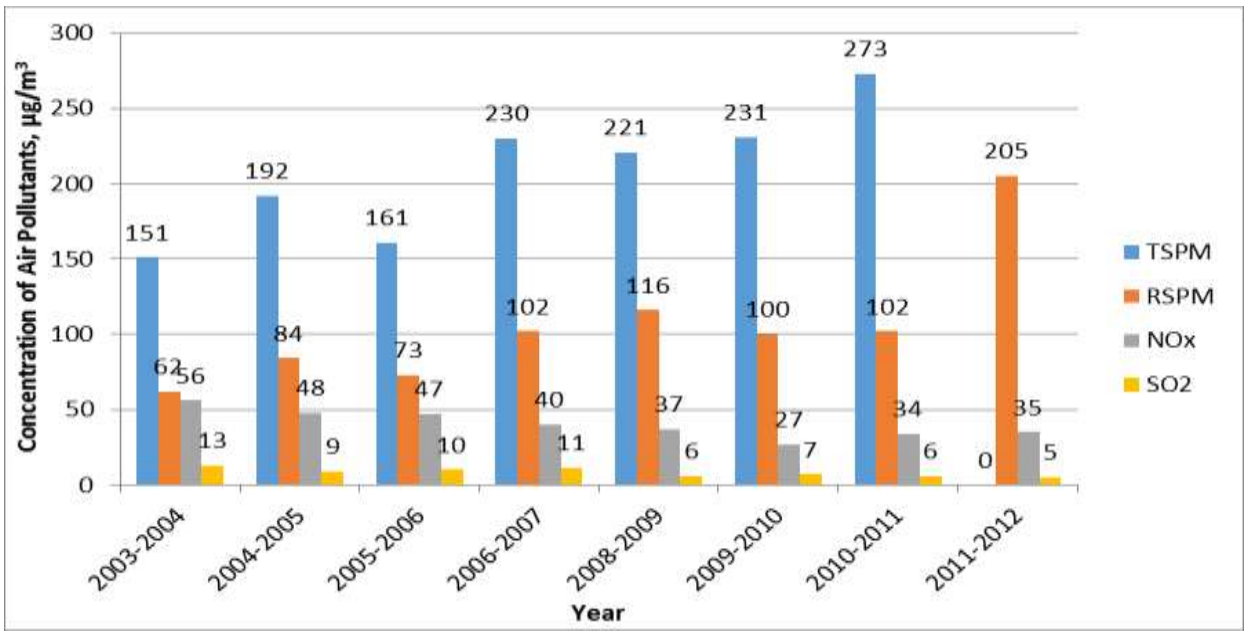


Figure. 3.6 Graph showing Ambient Air Quality in SIDCO Coimbatore between 2003-2012

Table 3.34 Ambient Air Quality Monitoring Results of Thoothukudi between 2003&2012				
a. Location: Raja Agencies, Thoothukudi				
Category -Industrial Area				
Year	Annual Average Concentation of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	35	29	22	20
2004-2005	62	39	17	20
2005-2006	81	61	20	19
2006-2007	125	90	17	18
2008-2009	281	166	19	27
2009-2010	254	135	12	15
2010-2011	310	178	14	12
2011-2012	NA	132	13	7
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

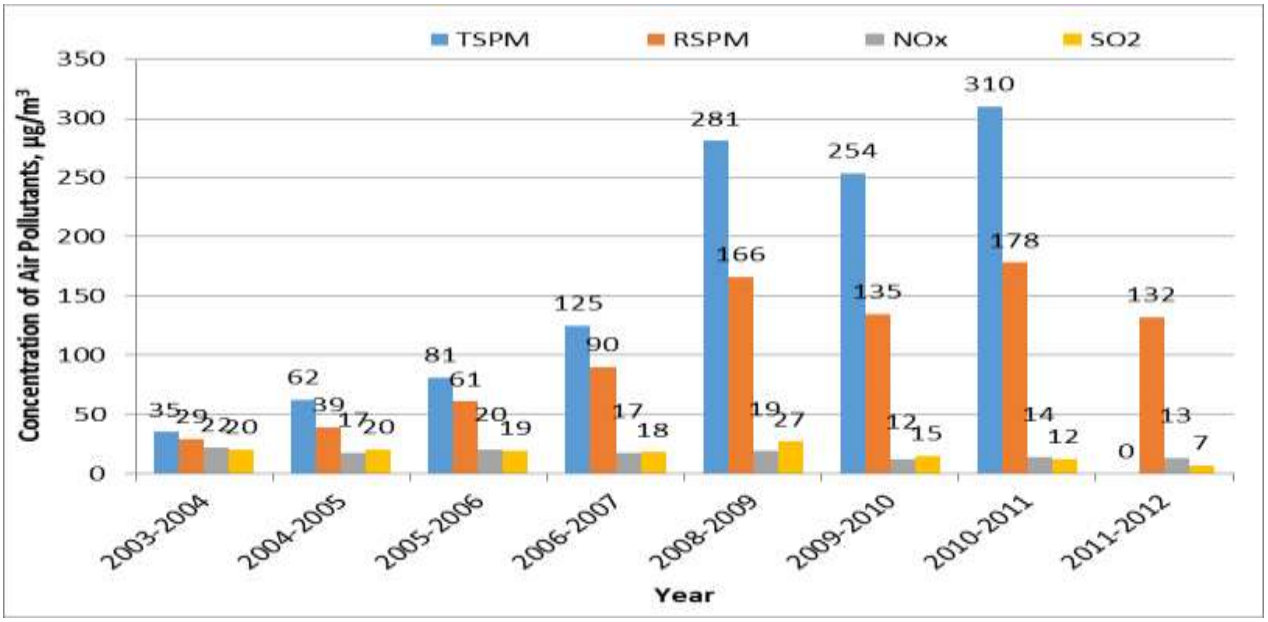


Figure. 3.7 Graph showing Ambient Air Quality in Thoothukudi between 2003-2012

Table 3.35 Ambient Air Quality Monitoring Results of Thoothukudi between 2003&2012				
b. Location: AVM Building, Thoothukudi				
Category -Mixed Area				
Year	Annual Average Concentation of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	41	34	20	19
2004-2005	71	46	18	19
2005-2006	105	83	20	19
2006-2007	116	78	18	18
2008-2009	152	99	17	30
2009-2010	97	47	13	15
2010-2011	90	53	14	10
2011-2012	NA	81	14	7
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

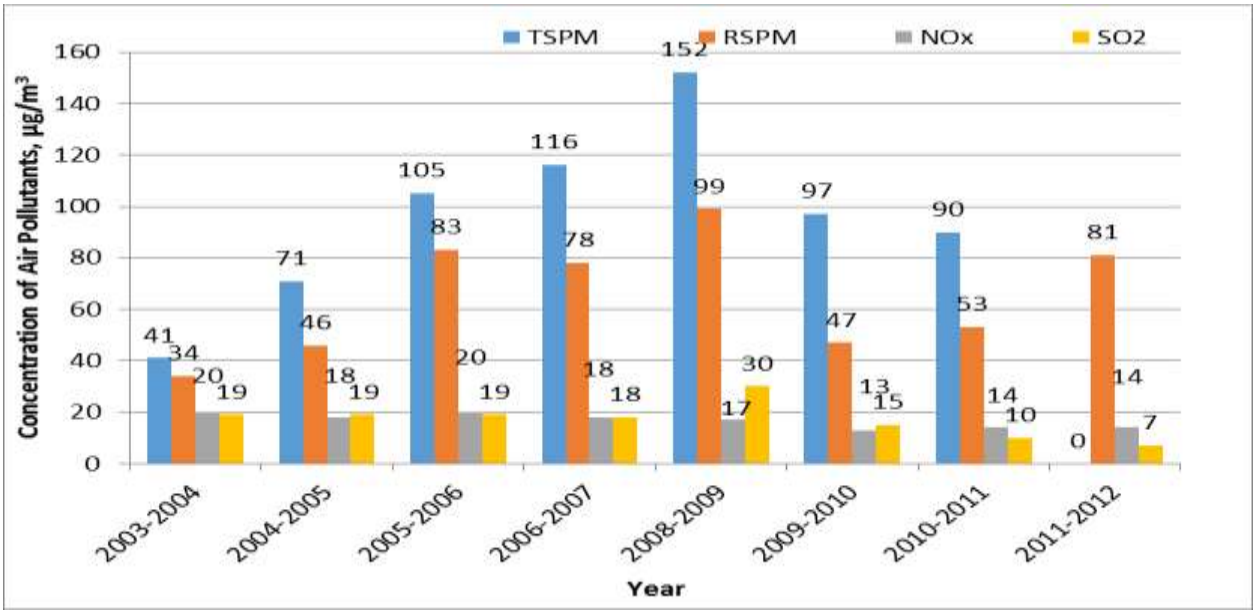


Figure. 3.8 Graph showing Ambient Air Quality in Thoothukudi between 2003-2012

Table 3.36 Ambient Air Quality Monitoring Results of Thoothukudi between 2003&2012				
c. Location: Fisheries College/SIPCOT,Thuthookudi				
Category -Industrial Area				
Year	Annual Average Concentation of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	38	30	19	20
2004-2005	60	38	18	19
2005-2006	66	54	22	19
2006-2007	90	63	17	17
2008-2009	130	86	19	30
2009-2010	138	70	11	17
2010-2011	156	88	12	12
2011-2012	NA	112	15	9
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

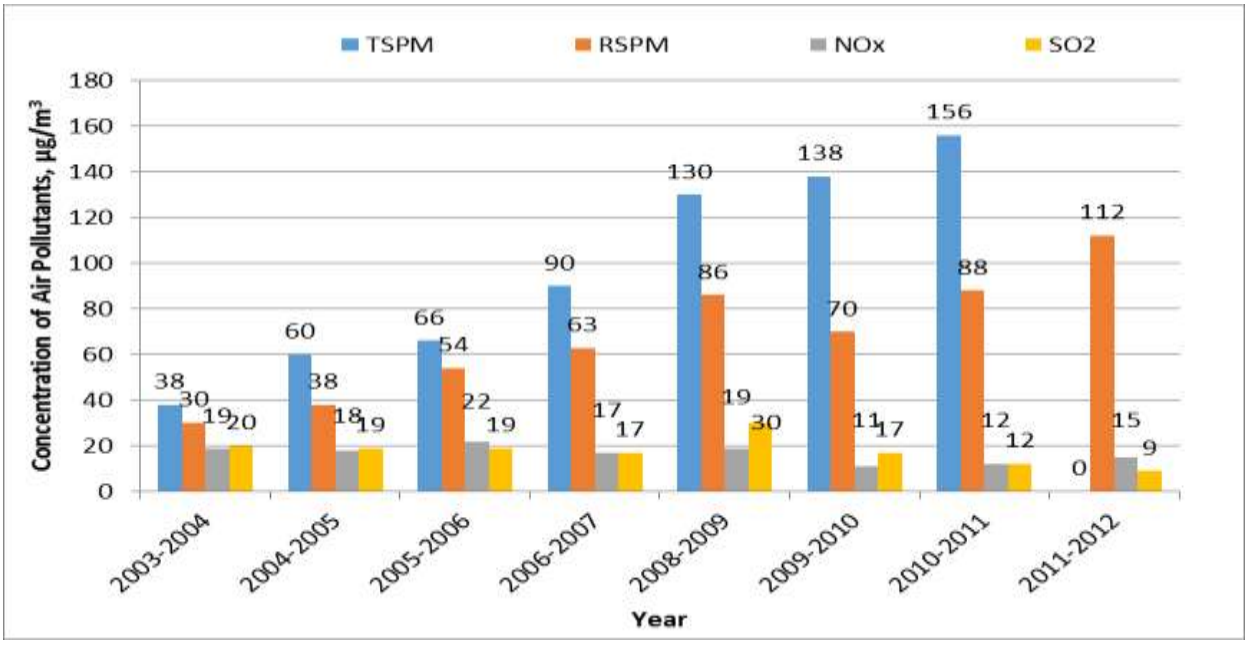


Figure. 3.9 Graph showing Ambient Air Quality in SIPCOT Thoothukudi between 2003-2012

Table 3.37 Ambient Air Quality Monitoring Results of Madurai between 2003&2012				
a. Location: Fennar Ltd, M/s.Susee cars & Trucks (p)Ltd., Madurai				
Category -Industrial Area				
Year	Annual Average Concentration of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	163	72	29	22
2004-2005	136	52	28	18
2005-2006	117	37	29	17
2006-2007	94	65	26	12
2008-2009	91	45	24	11
2009-2010	81	36	25	11
2010-2011	111	42	25	11
2011-2012	NA	44	23	10
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

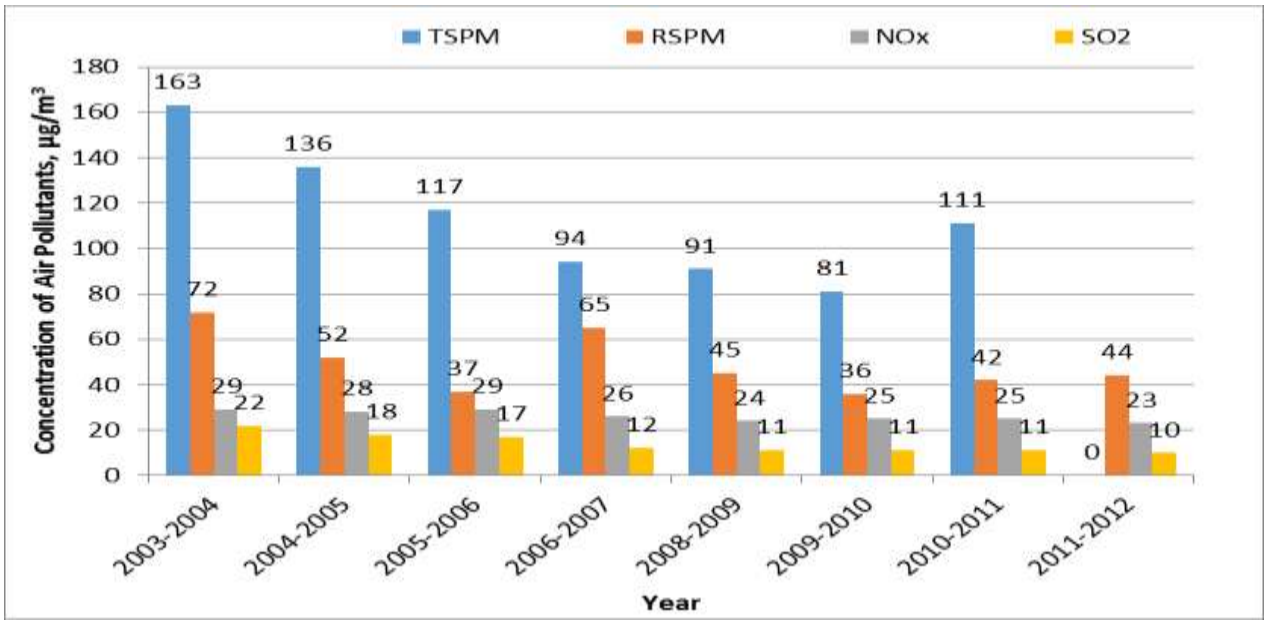


Figure. 3.10 Graph showing Ambient Air Quality in Madurai between 2003-2012

Table 3.38 Ambient Air Quality Monitoring Results of Madurai between 2003&2012				
b. Location: Kunnathur Chatram/Avvai Girls Hr.Sec.school Madurai				
Category -Mixed Area				
Year	Annual Average Concentration of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	416	154	31	9
2004-2005	355	177	22	9
2005-2006	208	57	28	10
2006-2007	103	34	23	10
2008-2009	87	49	24	10
2009-2010	104	76	24	10
2010-2011	107	45	25	8
2011-2012	NA	46	24	11
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

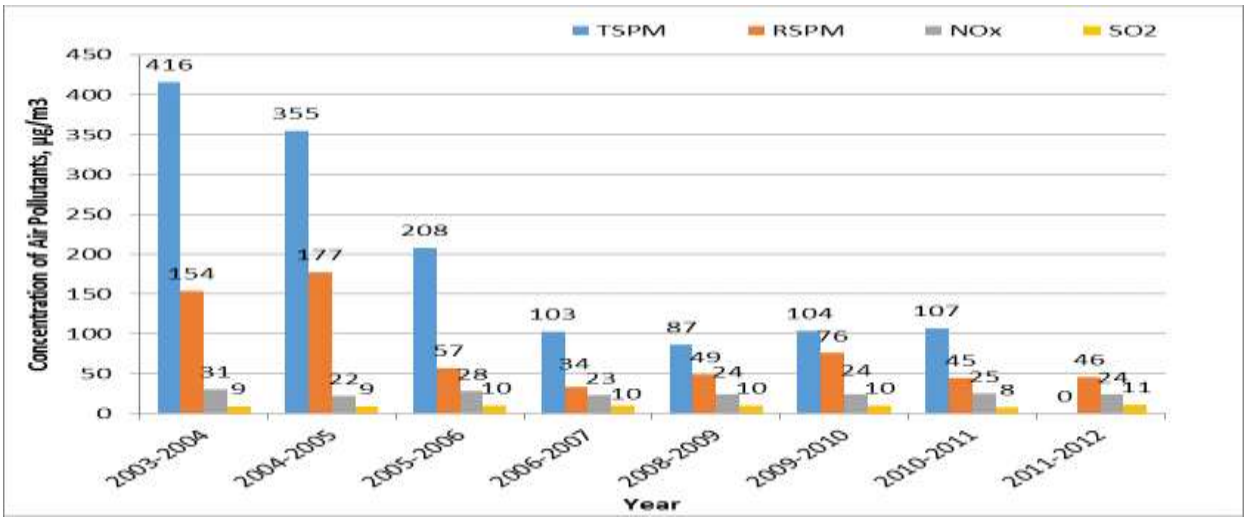


Figure. 3.11 Graph showing Ambient Air Quality in Kunnathur Chatram Madurai between 2003-2012

Table 3.39 Ambient Air Quality Monitoring Results of Madurai between 2003&2012				
c. Location: Highway Project Building, Madurai				
Category -Residential Area				
Year	Annual Average Concentation of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	135	60	25	8
2004-2005	109	51	20	9
2005-2006	110	37	27	9
2006-2007	98	37	23	9
2008-2009	84	41	24	10
2009-2010	97	46	25	10
2010-2011	101	47	24	11
2011-2012	NA	47	24	10
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

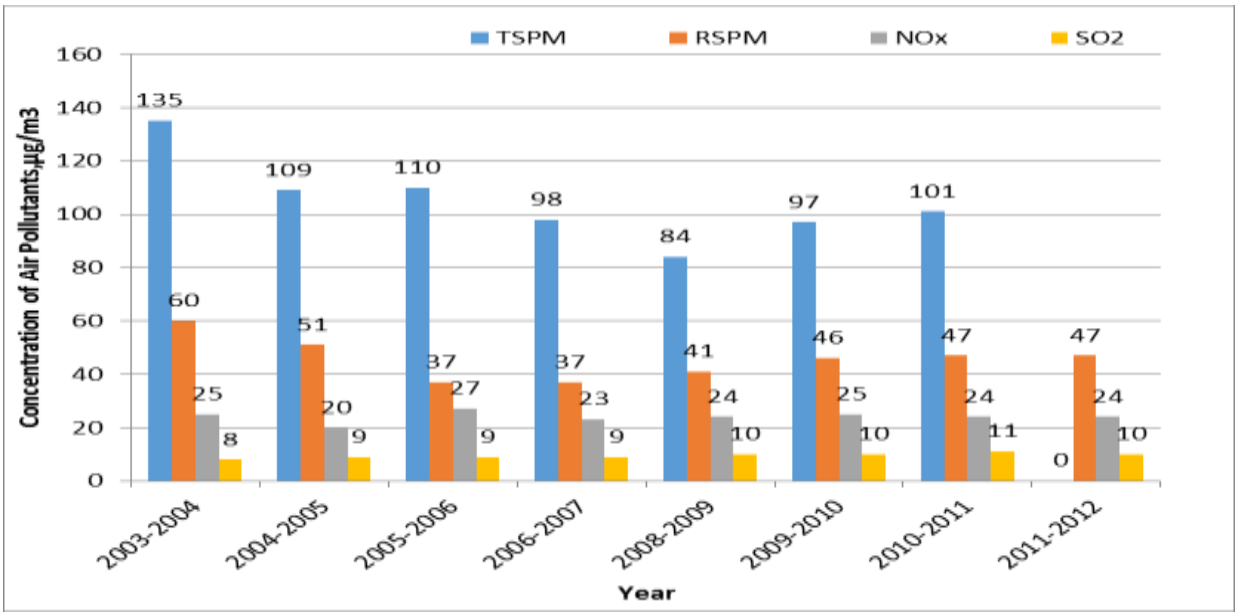


Figure. 3.12 Graph showing Ambient Air Quality in Highway Project Building -Madurai between 2003-2012

Table 3.40 Ambient Air Quality Monitoring Results of Salem between 2003&2012				
a. Location: Sowdeswari College Building , Salem				
Category -Mixed Area				
Year	Annual Average Concentration of Air pollutants, µg/m^3			
	TSPM	RSPM	NOx	SO_2
2003-2004	66	28	37	8
2004-2005	71	38	34	7
2005-2006	69	42	33	7
2006-2007	69	42	33	7
2008-2009	118	79	25	9
2009-2010	133	85	24	9
2010-2011	111	74	24	9
2011-2012	NA	62	21	8
Prescribed Standard				
Industrial	360	120	80	80
Residential, Rural & Other Areas (Mixed)	140	60	60	60
NAAQS-2009	NA	60	40	50

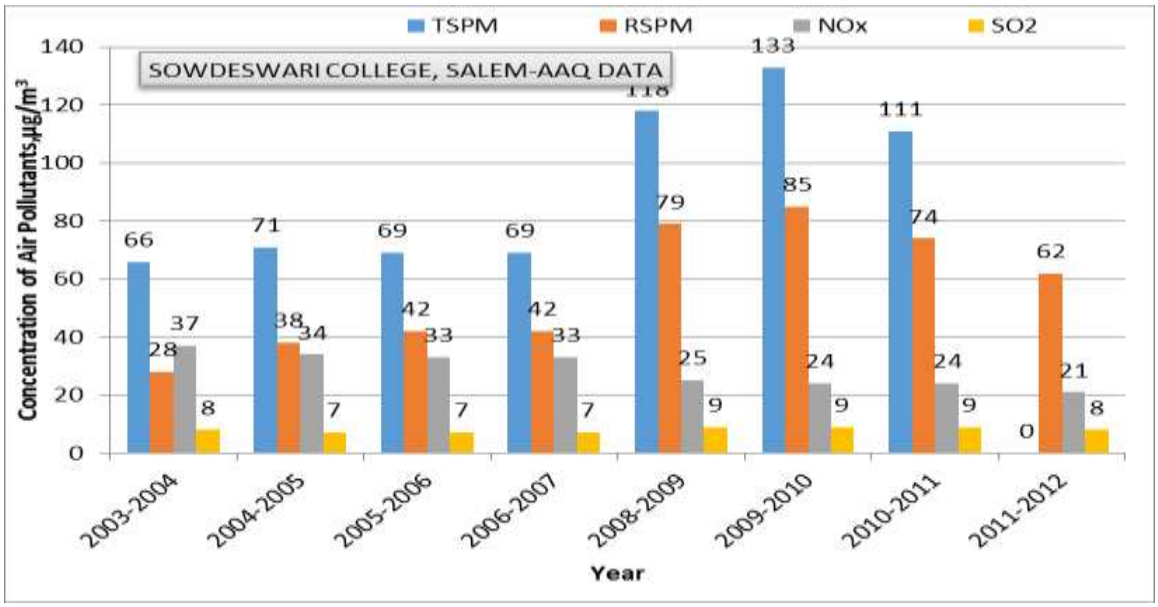


Figure. 3.13 Graph showing Ambient Air Quality in Salem between 2003-2012

From the above data it is clearly seen that levels of RSPM and TSPM are found to be high across all industrial and urban areas in Tamil Nadu.

3.3 Status of Number of Vehicles in Tamil Nadu

Table 3.41 Number of vehicles in Tamil Nadu - 2013

District wise Number of Commercial Vehicles As On 01.4.2013													
Sl.No.	Name Of The District	Stage Carriages		Mini Buses	Autorick-Shaws	Ordi-Nary Taxi	Motor Cabs		Maxi Cabs		Omni Buses		Psv
		Public	Private				Sp	Aip	Sp	Aip	Sp	Aip	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Chennai	6546	6	0	70675	531	21560	7550	16023	3484	189	57	3474
2	Kancheepuram	659	177	112	3741	0	2189	148	4670	38	66	0	2950
3	Tiruvallore	182	108	62	5927	0	2872	832	2958	752	11	0	569
4	Vellore	599	615	98	14095	132	862	539	1337	126	0	2	478
5	Tiruvannamalai	271	331	157	2581	2	1309	372	661	65	0	5	66
6	Cuddalore	401	345	122	4011	8	2876	113	1802	10	0	0	54
7	Villupuram	755	303	172	8030	23	3428	124	1473	68	5	0	27
8	Salem	855	501	215	5955	5	2281	161	1894	16	88	9	162
9	Namakkal	266	518	203	821	0	1948	45	930	8	42	0	329
10	Dharmapuri	394	314	55	1767	0	557	63	434	18	1	0	18
11	Krishnagiri	494	143	48	3084	0	290	488	414	55	3	0	157
12	Trichy	769	465	204	9791	1895	4180	186	2288	83	63	9	178
13	Karur	116	167	117	1216	0	537	12	442	6	4	0	156
14	Perambalur	67	72	98	522	0	604	10	353	1	0	0	16
15	Ariyalur	125	31	34	209	0	520	4	323	0	0	0	11
16	Thanjavur	601	226	167	5677	12	2651	157	1484	131	52	21	22
17	Nagapattinam	170	162	189	4185	0	1983	22	1023	146	16	0	15
18	Tiruvarur	180	96	84	1525	0	1490	14	629	13	0	0	2
19	Pudukkottai	357	189	49	1483	61	1245	0	869	0	0	5	31
20	Erode	463	512	155	2780	0	3164	127	1366	15	4	4	341
21	Coimbatore	1203	448	161	10782	69	11629	155	3746	9	43	41	658
22	Udhagamandalam	423	0	118	2967	838	1781	462	710	37	0	2	54
23	Tiruppur	513	306	87	1733	15	1956	18	1285	5	17	0	779
24	Madurai	1184	240	274	13252	0	4117	142	3133	65	27	2	271
25	Dindigul	519	376	102	4848	32	2438	21	1457	16	18	0	181
26	Theni	258	103	109	5750	0	1193	65	1391	30	34	0	160
27	Virudhunagar	339	268	149	3345	0	1690	15	1413	8	11	0	1165
28	Sivagangai	285	170	58	2373	2	1647	4	784	0	5	0	52
29	Ramanathapuram	337	106	60	5134	8	1090	13	1578	2	0	0	14
30	Tuticorin	330	189	166	3904	68	2357	6	1517	1	44	6	307
31	Tirunelveli	556	292	267	10072	25	4556	13	3333	0	7	0	391
32	Kanniyakumari	684	78	233	6094	25	1887	0	1963	0	0	0	130
	State Total	22053	8060	4125	218329	3751	92887	11881	63683	5208	750	163	13218
	Chennai -City	6546	6	0	70675	531	21560	7550	16023	3484	189	57	3474

Source : Transport Department , Govt. of Tamil Nadu

Table 3.42 Number of vehicles in Tamil Nadu - 2003

DISTRICTWISE NUMBER OF COMMERCIAL VEHICLES AS ON 01.04.2003

SL. NO.	Name of the District	Stage Carriages		Mini Buses	Auto Rick-Saws	Ordi Nary Taxi	Motor Cabs		Maxi cabs Cabs		Omni Buses		Private Service Vehicle	Sch-Ool Bus	Ambu-Lance	Fire Figh-Ter	Light Commercial Vehicle	Lorri-Ies	Arti-Culated Vehicle	National Permit		Trac-Tors & Trai-Lers	Total Trans-Port Vehicles
		Pub-Lic	Pri-Vate				Sp	Aip	Sp	Aip	Sp	Aip								Lorri-Ies	Articulated Vehicle		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	**Chennai**	3673	0	0	39782	222	5162	2400	3828	191	138	66	690	740	645	64	7156	16334	988	2939	649	660	86327
2	**Kancheepuram**	765	157	84	8145	41	1622	659	1272	32	5	3	232	387	85	30	2076	3912	73	329	7	1761	21677
3	**Tiruvallore**	80	108	59	2961	0	496	80	1154	47	0	0	36	118	35	4	935	4292	68	490	12	385	11360
4	**Vellore**	554	413	87	5943	27	230	78	585	14	3	4	176	60	43	20	269	5810	124	1767	14	1230	17451
5	**Tiruvannamalai**	176	280	150	1744	0	44	62	294	16	1	2	33	17	42	10	491	1979	98	385	0	344	6168
6	**Cuddalore**	336	291	115	3027	32	1787	37	1186	23	4	1	52	37	67	25	146	2816	488	614	3	1572	12659
7	**Villupuram**	586	293	156	1650	14	906	25	738	14	8	0	137	50	49	66	297	2903	334	638	2	1426	10292
8	**Salem**	470	416	166	3606	2	1252	41	834	40	19	16	109	213	68	33	4269	4622	298	2401	33	1523	20431
9	**Namakkal**	248	252	209	401	1	585	41	405	9	6	2	82	108	47	8	1836	5735	2479	6082	573	2042	21151
10	**Dharmapuri**	662	212	131	3169	0	213	39	312	10	1	0	120	275	58	19	1364	3438	94	573	50	870	11610
11	**Trichy**	507	362	192	4739	17	2570	28	1126	24	30	20	65	131	91	30	2775	4777	479	826	124	1353	20266
12	**Karur**	111	263	130	807	0	272	25	163	6	8	2	24	15	48	7	1211	2045	169	599	53	863	6821
13	**Perambalur**	170	97	147	363	0	441	5	300	8	3	0	34	49	17	1	119	920	17	161	10	1000	3862
14	**Thanjavur**	387	243	203	2900	6	1371	67	982	15	2	2	61	19	37	16	958	2499	117	102	0	1452	11439
15	**Nagapattinam**	195	88	150	1597	4	1795	66	774	25	5	0	24	42	21	10	281	1196	121	169	12	1466	8041
16	**Tiruvarur**	170	82	103	1165	0	1293	2	452	7	0	0	3	7	4	1	389	812	6	25	26	344	4891
17	**Pudukkottai**	309	159	49	1155	2	999	38	822	3	11	0	28	46	65	19	458	2362	100	128	2	545	7300
18	**Erode**	530	423	168	2642	7	1283	86	823	9	5	5	126	169	86	46	3280	7637	1252	1613	3	2376	22569
19	**Coimbatore**	1255	580	215	8407	41	2872	314	1672	84	15	8	518	785	207	93	7155	12663	1014	2071	7	2814	42790
20	**Udhagamandalam**	359	0	98	1837	88	564	82	393	36	2	1	45	85	88	12	428	653	160	236	0	427	5594
21	**Madurai**	817	196	238	6190	0	1448	115	1411	29	33	6	111	320	114	63	2253	3906	160	459	0	1523	19392
22	**Dindigul**	321	301	132	2459	24	1019	52	668	3	5	1	73	228	45	12	510	3184	107	384	0	1363	10891
23	**Theni**	242	73	90	961	0	257	56	665	14	8	2	94	87	44	10	303	1487	290	432	0	875	5990
24	**Virudhunagar**	348	179	134	1206	3	637	38	1032	11	4	2	195	205	107	23	1748	2277	106	482	0	874	9611
25	**Sivagangai**	258	130	59	1089	17	696	39	528	6	3	0	34	140	42	6	673	1301	430	34	0	498	5983
26	**Ramanathapuram**	295	65	46	2002	0	647	21	401	3	0	0	32	30	49	6	537	563	101	70	0	669	5537
27	**Tuticorin**	316	171	172	1835	66	1244	59	1146	17	3	0	204	103	104	28	1219	2774	95	329	290	764	10939
28	**Tirunelveli**	445	308	184	4341	179	2111	110	2778	43	7	4	89	262	156	39	3175	5076	193	205	11	2099	21815
29	**Kanniyakumari**	677	0	236	3596	121	1547	48	1266	65	0	0	53	195	92	34	1928	2171	77	196	6	928	13236
	State -total	16414	6345	3903	119719	914	35363	4713	28010	804	329	147	3480	4923	2556	735	48239	110144	10038	24739	1887	34046	457448
	Chennai city	3673	0	0	39782	222	5162	2400	3828	191	138	66	690	740	645	64	7156	16334	988	2939	649	660	86327

Source : Transport Department , Govt. of Tamil Nadu

Table 3.43 Number of Vehicles in the State during 2003 and 2013

Year	Name Of The District	Stage Carriages		Mini Buses	Autorick-Shaws	Ordi-Nary Taxi	Motor Cabs		Maxi Cabs		Omni Buses		PSV
		Public	Private				SP	AIP	SP	AIP	SP	AIP	
2003	**State - Total**	16414	6345	3903	119719	914	35363	4713	28010	804	329	147	3480
2013		22053	8060	**4125**	**218329**	**3751**	**92887**	**11881**	**63683**	**5208**	**750**	**163**	**13218**

Source : Transport Department , Govt. of Tamil Nadu

Table 3.44 Number of Vehicles in the Chennai during 2003 and 2013

Year	Name Of The District	Stage Carriages		Mini Buses	Autorick-Shaws	Ordi-Nary Taxi	Motor Cabs		Maxi Cabs		Omni Buses		PSV
		Public	Private				SP	AIP	SP	AIP	SP	AIP	
2003	**State - Total**	3673	0	0	39782	222	5162	2400	3828	191	138	66	690
2013		6546	6	0	70675	531	21560	7550	16023	3484	189	57	3474

Source : Transport Department , Govt. of Tamil Nadu

The number of Vehicles has a direct indication on the Air pollution in the State. Urban areas like Chennai City have high levels of air pollution especially levels of CO and So2, due to the high number of vehicles. Further improper combustion of fuels and bad maintenance of vehicles add to the Pollution from vehicles. Frequent Checking is needed across the state to keep a check on the emissions from vehicles.

3.4 Action Taken to Prevent Air Pollution in Tamil Nadu

(a) Industrial Pollution

The salient features of actions taken to control industrial pollution are as follows:

- No new polluting units are permitted within the city.
- No new incinerators are permitted within the city, old incinerators being phased out.
- Common facilities are set up outside the city for incineration of Bio-medical Waste.
- The industries have been directed to develop a green belt of minimum 33% of the project area . Green belt is also being developed by industries on road sides as avenue plantations . Renewal of the consent is based on compliance with this condition.
- Periodic inspection of industrial units is to be fitted with online stack monitor connected to the pollution control board – CARE Air centre.

(b) Vehicular Pollution

The salient features of action taken to control vehicular pollution are as follows :

- Bharat Stage –II norms have been implemented for the registration of new passenger car from 1-7-2011.
- Emission norms for in-use vehicles in consultation with MoRTH & MoEF have been implemented in Chennai city for all vehicles from 1-1-1997.
- Catalytic Converter fitted passenger car have been registered since , 1997.
- Periodic inspection of in use vehicles in Chennai is conducted by the officials of transport Department and Police Department .
- Supply of Unleaded petrol from February 2000.
- In Chennai City Low sulphur diesel (0.05%) is supplied since 1-7-2001.
- Supply of Pre-mixed 2T oil since 1-4-2002
- Entry of heavy vehicles is restricted by the road in Chennai city during peak hours .
- Ring Road have been constructed to avoid the entry of inter city vehicles in the city .
- Mass transport system (metro Rail) from Beach to Velachery is completed.
- Fiscal Measures like structuring parking fees and road tolls has been implemented.

5. Waste Management

Waste is defined as any unwanted or unusable material, substances or by-products. Solid Wastes can be broadly classified based on its source into:

- Bio-medical Wastes
- E-Wastes
- Hazardous Wastes
- Municipal Solid Wastes
- Plastic Wastes

Waste management is the collection, transport, processing or disposal, managing and monitoring of waste materials. Waste Management is important in order to control the impacts and effects of wastes on our Ecosystems and Human Health.

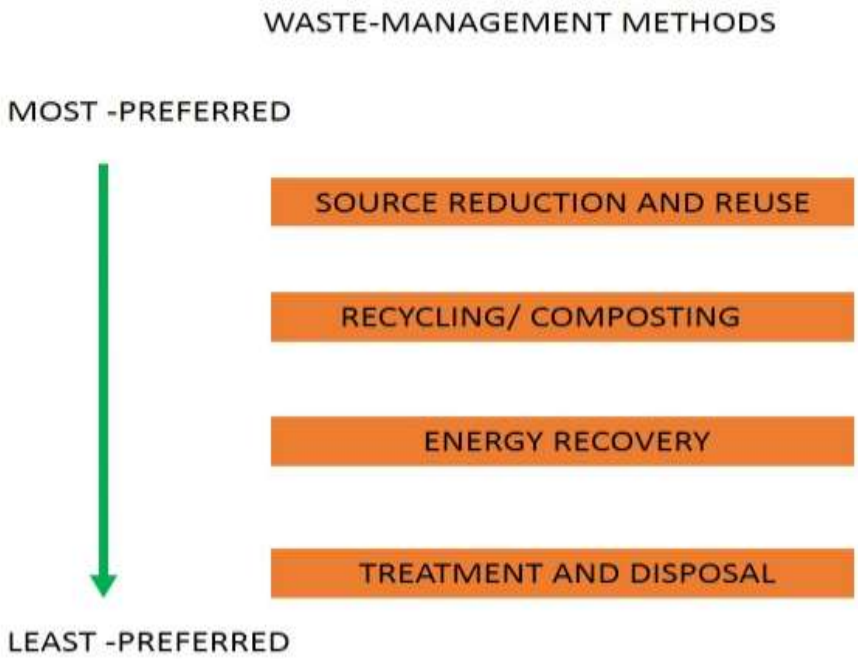


Figure 4.1 Waste Management Hierarchy

The above diagram shows the waste management hierarchy. Source reduction and reuse is the most preferred, as it will cause less waste generation. Treatment and disposal is a tedious process and is least preferred.

List of Acts and Policies at the National / State Level related to Waste Management:

- Tamil Nadu Public Health Act, 1939
- The Environmental (Protection) Act, 1986
- Bio-medical Waste (Management & Handling) Rules, 1998
- Hazardous Waste (Management & Handling) Rules, 2000
- Municipal Solid Waste (Management & Handling) Rules, 2000
- Batteries (Management and Handling) Rules, 2001
- Plastic Manufacture and use rules 1999 with amendments in 2003
- E-wastes (Management and Handling) Rules; 2011

4.1 Bio-Medical Wastes

Biomedical wastes include waste associated with medical, laboratory origin (hospital waste, used bandages, waste blood etc), as well research laboratory waste containing bio-molecules.

They are potentially infectious and can cause diseases if they are not treated and disposed properly. Bio-medical wastes can be solid or liquid in nature. Examples include infectious waste--discarded blood, sharps, unwanted microbiological cultures, and body parts, other human or animal tissue, used

bandages and dressings, discarded gloves, medical supplies that might have been in contact with body fluids, and laboratory waste that have similar characteristics as described above. Waste Sharps include potentially contaminated used, unused or discarded needles, scalpels. Bio-Medical Wastes are segregated into the following Colored Bags :

Yellow Bags	**Red Bags**	**Blue Bags**	**Black Bags**
-Infectious Wastes, Bandages , Gauzes , cotton or any other in contact with Bodily Fluids , Human Body parts , Placenta	- Plastic wastes such as injections , syringes , tubes , bottles .	-All Types of glass Bottles and broken glass articles , outdated & discarded medicines	-Needles without syringes , blades sharps and metal articles

4.1.1 Sources

Biomedical waste is generated from biological and medical sources and activities, such as the testing and treatment of diseases. Common sources include hospitals, health clinics, nursing homes, medical research laboratories, dentists, veterinarians, and funeral homes. In healthcare facilities (i.e., hospitals, clinics, doctors' offices, veterinary hospitals and clinical laboratories)

Figure 4.2 International Symbol for Biological Hazard.

The Bio-medical Waste (Management & Handling) Rules, 2011

The Bio-medical Waste (Management & Handling) Rules, 2011 categorizes the wastes into 10 categories:

Table 4.1 Biomedical Waste Classification

Waste Category No.	Waste Category Type	Treatment and Disposal
Category No.1	**Human Anatomical Waste** (human tissues, organs, body parts)	Incineration / deep burial
Category No.2	**Animal Waste** (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals, colleges, discharge from hospitals, animal houses)	Incineration/deep burial
Category No.3	**Microbiology & Biotechnology Wastes** (Wastes from laboratory cultures, stocks or specimens of	local autoclaving/micro-

	micro-organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biological, toxins, dishses and devices used for transfer of cultures)	waving/incineration
Category No.4	**Waste sharps :** (Needles, syringes, scalpels, blades, glass etc. that may cause puncture and cuts. This includes both used and unused sharps)	disinfection (chemical treatment/autoclaving/ microwaving and /shredding
Category No.5	**Discarded Medicines and Cytotoxic drugs** (wastes comprising of outdated, contaminated and discarded medicines)	incineration/destruction and drugs disposal in secured landfills
Category No.6	**Soiled Waste** (Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, lines beddings, other material contaminated with blood)	Incineration autoclaving/microwaving
Category No.7	**Solid Waste** (wastes generated from disposable items other than the waste [sharps] such as tubing, catheters, intravenous sets etc.)	disinfection by chemical treatment autoclaving/ microwaving and mutilation/shredding
Category No.8	**Liquid Waste :** (waste generated from laboratory and washing, cleaning, house-keeping and disinfecting activities)	Disinfection by chemical treatment and discharge into drains.
Category No.9	**Incineration Ash :** (ash from incineration of any bio-medical waste)	disposal in municipal landfill
Category No.10	**Chemical Waste** (Chemicals used in production of biological, chemicals used in disinfection, as insecticides etc.)	Chemical treatment and discharge into drains for liquids and secured landfill for solids

Applicability of BMW Rules, 1998, 2011

The BMW Rules are applicable to every occupier of an institution generating biomedical waste which includes a hospital, nursing homes, clinic, dispensary, veterinary institutions, animal houses, pathological lab, blood bank by whatever name called, the rules are applicable to even handlers.

However the new draft Rules, 2011 are different from the earlier Rules, 1998.

The new Rules are comprehensive which contain important features of the Bio-Medical Waste (Management and Handling) Rules, 1998, including the three amendments issued. Several new provisions have been added in the new Rules.

(1) In the new Rules, it has been clearly mentioned that these rules are applicable only to the bio-medical wastes and shall not apply to other wastes such as radioactive wastes, hazardous chemicals, municipal solid waste, hazardous wastes and batteries waste, which are covered under the respective rules.

(2) In the new rules, it has been stipulated that ^every occupier shall set up requisite biomedical waste treatment equipments prior to commencement of its operation or shall make necessary arrangements in order to ensure requisite treatment of bio-medical waste through an authorized common bio medical waste treatment facility.

(3) As per the earlier Rules, obtaining authorization from prescribed authority was not required by an occupier of an institution which was providing service to less than 1000 (one thousand) patients per month. Under\the new Rules every occupier or operator, irrespective of the number of patients being serviced or the quantum of bio-medical waste generation, is required to obtain authorization.

(4) Under the existing rules, there was overlapping with regard to colour coding and segregation of waste. For instance, wastes under category-3 and 6 can be collected either in Yellow or Red bags. Similarly, wastes under category-7 may be collected either in Red or Blue bags. This caused confusion in segregation. In the new Rules, colour coding for containers or bags (Yellow, Red, Blue and Black) for collection of various categories of bio-medical wastes including the treatment options has been clearly specified to avoid overlapping and confusion.

(5) In the new Rules, duties for operator of a Common Bio-Medical Waste Treatment Facility as well as other concerned Authorities have been stipulated, in addition to the duties of occupier of a health care establishment.

(6) In the new Rules, the number of categories of wastes has been reduced from ten to eight. Color coding for collection of non-infectious waste (general waste) has also been prescribed.

(7) The guidelines issued by the CPCB and the Central Government have & been now made part of the Rules.

Common Biomedical wastes treatment facility [CBWTFs]

The Common Biomedical wastes treatment facility, which cast the responsibilities on municipal bodies to collect biomedical wastes/treated biomedical wastes and also provide sites for setting up of incinerator.) The owner of CBWTFs are service providers, who are providing services to health care units for collection of BMWs for its final disposal to their site.

4.1.2 Inventory of Tamil Nadu

The Tamil Nadu Pollution Control Board enforces the Biomedical Waste (Management and Handling) Rules, 1998 as amended in 2000. As part of this process, the Board has so far inventoried 317 Government hospitals and 1,835 private hospitals. The Board has issued directions to the Government and private hospitals to take time-bound action for identifying sites and setting up common facilities for management of biomedical wastes in coordination with the Indian Medical Association.The components of a common biomedical waste treatment and disposal facility [CBWTFs] are autoclave, shredder, compactor, and incinerator for anatomical waste, secured landfill facility, laboratory and vehicles for transportation of wastes.

Table 4.2 Bio-medical Waste Generation and Treatment In Tamil Nadu												
Name of the State Pollution Control Board (or) Pollution Control Committee:							**Tamilnadu Pollution Control Board**					
Name of the Nodal Officer with contact telephone no. & mobile no.							**Er.D. Sekar, Joint Chief Environmental Engineer, Telephone No. 044 22353144 Mobile No. 8754425662**					
S. No	**Name & Address of the CBWTF with contact person name and telephone no.**	**Name of the cities/ areas covered by CBWTF**	**Total no.of HCFs being covered**	**Total no.of beds covered**	**Total Quantity of BMW collected, treated and disposed of (in kg/day)**	**Cost of treatment of BMW changed by the CBWTF operator(Rs. per kg or Rs per bed per day)**	**Treatment equipment/facilities installed at CBWTF**			**Air Pollution Control Systems attached with the incinerator (s)**	**Method of Disposal of treated wastes (incineration Ash/Shapes/Plastics)**	**Compliance Status**
							Equipments	**Nos**	**Total installed capacity in kg/day**			
1.	M/s. G.J. Multiclave(India) Pvt Ltd, Thenmelpakkam,Chengalpattu Taluk, Kanceepuram District	Part of Chennai, Kanceepuram and Tiruvallur Dt	564	24450	7335	Pvt- Rs.4 per bed per day Govt-Rs. 26/kg	Incinerator	2	200 kg/hr & 200 kg/hr	Dust Collector and wet scrubber	Incineration Ash: Secured land fill	No.of Showcause notices/ Direction issued: NIL
							Autoclave		600 lts/cycle 763 lts/cycle			
							Hydroclave				Sharp concrete Pits	No. Of Court cases: NIL
							Microwave					
							Shredder	1	50 kg/hr 75 kg/hr		Plastics: authorized recyclers	Others: NIL
							ETP	1				
							Deep Burial					
2	M/s.Taminadu Waste Management Ltd., Kinnar Village, Maduranthagam T.K Kanceepuram District.	Chennai(North) Tiruvallur Dt. Cuddalore Dt. Villupuram Dt. Kanceepuram Dt.(Part)	502	21520	7125	Rs.4.00/bed/day for Pvt Hospitals & Rs.26/kg for Govt Hospital	Incinerator	1	200 kg/hr	Quencher, Venturi wet scrubber, Mist eliminator	Incineration Ash: secured land fill	No.of Show-cause notices/Direction issued:1
							Autoclave	1	810 Lts/cycle		Sharps: Sharp pit	No. of Court cases:
							Hydroclave					
							Microwave				Plastics: authorized recyclers	Others:
							Shredder	1	150 kg/hr			
							ETP	1				
							Deep Burial					
3	M/s. Medicare Enviro Systems,Sengipatti,Thanjavur Taluk,Thanjavur District.	Thanjavur Dt,Trichy Dt,Tiruvarur Dt,Nagapattinam Dt, Karaikal, Pudukottai Dt, Perambalur Dt, Sivagangai Dt, Ariyalur	593	17320	3225	Govt- Rs.28-31 per kg Pvt-Rs.3.50/bed per day to Rs 4/bed per day	Incinerator		150 kg/hr	Hood with Suction arrangements. Venturi Scrubber with Stack of 30 m	Incineration Ash: Secured Land fill	No.of Show-cause notices/Direction issued: NIL
							Autoclave		500 Lts/ Batch			
							Hydroclave				Sharpes:stored in sharp pits	No.of court cases: NIL
							Microwave					
							Shredder				Plastics: Solid out to authorized recycler	Others :NIL-
							ETP					
							Deep Burial					
4	M/s Ken Bio Links Private Ltd., Kandipedu, Katpadi Taluk, Vellor District	Vellor Dt, Tirvannamalai Dt, Vaniyambadi Dt.	305	7162	2900	Rs. 29/kg for govt Hospital &Rs.4.50/bed /day for Pvt Hospitals	Incinerator	1	150kg/hr	Wet scrubber	Incineration Ash: secured landfill	No. of Show –cause notices/ Direction issued:1
							Autoclave				Sharps: Sharp pit	No.of Court Cases:
							Hydroclave					
							Microwave				Plastics: Sold to authorized recycler	Others:
							Shredder					
							ETP					
							Deep Burial					

5	M/s. Society for Ilia Medical Waste Management,Udha gamandalam, The Nilgiris District. Dr. Muralidharan 9443475946	Nilgris Dt	161	961	2450	Rs.20000 per hospital per year Rs.3500 for clinic/year, Rs. 4000 for lab/year	Incinerator		NIL	No incinerator	Incineration Ash: Does not arise	
							Autoclave	1	150 kgs / day			
							Hydroclave				**Sharps:** disposed into secured landfill	No. of Coon cases: NIL
							Microwave					
							Shredder	1	25 kgs/hr		Planks: storedinside the premises	Others: NIL
							ETP	1				
							Deep Burial	1				
6	M/s. Neat and Clean Service Squad, Muthuvayal, Rarnanathapurana District Mr.N.Ganesan 9965589523	Ramanathapura in Dt.	108	810	1894	Rs. 5per kg	Incinerator		NIL	No incinerator	Incineration Ash: Does not arise	N. of Show-ca use notices/ Direction issued: I
							Autoclave		100 kgs/hr			
							Hydroclave		NIL		Sharps: recyclers	No. of Court cases: NIL
							Microwave		NIL			
							Shredder		25 kgs/hr		Plastic. Sold our to authorized =cycler	Others: NIL
							ETP					
							Deep Burial		1.5*1.5.2.0 m			
7	M/s. Ramky Energy and Environment Ltd, Thangayur, Salem District. K.M. Nizat Ahamed Phone No. 0427 - 4041139 Mobile No. 96771 - 22708	Salem, Namakkal, Kam; Erode, Dhannapuri, Krishnagin	810	17250	3560	Pvt- Rs. 6.5/Bed/ day Govt - Rs. 40.50/ kg	Incinerator	1	150 kg/hr	Wet Scrubber, Venturi	Incineratio n Ash: secured Land Fill	No. of Show-cause notices/ Direction issued: 1
							Autoclave	1	650 Lt/cycle			
							Hydroclave		NA		Sharps: secured Land Fill	No. of Court Cases:NIL
							Microwave		NA			
							Shredder	2	50 kg/hr & 100 kg/hr		Plastics : Authorized recycles	Others: NIL
							ETP					
							Deep Burial					
8	M/s.Techno Therm Industries, Orattukuppai,Coim batore District. 0422 - 2307400	Coimbatore, Pollachi, Udumalpet, Mettupalayam, Tirupur, Sathyamangalam	317	10440	2400	Pvt - 5.50 per bed/ per day Govt - Rs. 29 per kg	Incinerator		250 kg/day	Quench Column, Scrubber Droplet Separator, ID Pan, 30 mts exhaust Chimney.	Incineration Ash: Land Fill	No. of Showcause notices/ Direction issued: 1
							Autoclave		800 h - 16000 hrs/day			
							Hydroclave		NA		Sharps: Sharp pit	No. of Court cases:
							Microwave		NA			
							Shredder		100 kg/In - 2000 kg/day		Plastics : after disinfectio n, shredding and despatch to authorized recycler	Others: NIL
							ETP		25 m3/day			
							Deep Burial		20 ft*10 ft*6 ft depth engineered secured land fill			

9	M/s. Aseptic System Bio Medical Waste Management Co., Pappankulam,Tirunelveli District. Mr. J.Elango 0462 - 2553268	Tirunelveli Dt. Tuticorin Dt. Kanyakumari Pt.	1126	20210	365 9	Rs3.00 to 4.50/ bed/day for Pvt Hospitals & Rs.26/kg for Govt Hospital	Incinerator	1	250 kg/hr	Wet scrubber	Incineratio n Ash: Land Fill	No. of Show-cause notices/ Direction issued: Nil
							Autoclave	1	150 kg/cycle			
							Hydroclave				Sharps: Sharps pit	No. of court cases: NIL
							Microwave					
							Shredder	1	150 kg/cycle		Plastics : authorized recycler	Other:NIL
							ETP					
							Deep Burial					
10	M/s. Ramky Energy and Environment Ltd., Undurmilcidakulam Virudhunagar District. Mr.T.K.Sridhar 9677105568	Madurai Dt. Virudhunagar Dt. Dindigul Dt. Theni Dt. & Govt Hospitals in Ramnad	1670	23020	4165	Rs3.50/ bed/day for Pvt Hospital & Rs.27/kg for Govt Hospital	Incinerator	1	150 kg/hr	Venturi Scrubber	Incineratio n Ash: Land Fill	No. of Show-cause notices/ Direction issued: Nil
							Autoclave	1	60 kg/cycle			
							Hydroclave				Sharps: Sharp pit	No. of Court Cases: NIL
							Microwave					
							Shredder				Plastics : authorized recycler	Others: NIL
							ETP	1	120 kg/hr			
							Deep Burial					
11	M/s. Kovai Bio Waste Management Pvt Ltd., Orattukuppai, Coimbatore District. 8870356543	Coimbatore, Nilgris	90	735	220	Pvt - 5.50 per bed/ per day Govt - Rs. 29 per kg issued:	Incinerator		200 kg/day	Quench Column, Scrubber.ID Pan, Chimney	Incineratio n Ash: Land Fill	No. of Show-cause notices/ Direction NIL
							Autoclave		300 Lt -16000 hrs/day			
							Hydroclave		NA		Sharps: Sharp pit	No. of Court cases: NIL
							Microwave		NA			
							Shredder		100kg/ht - 2000 kg/day		Plastics : authorized recycler	Others: NIL
							ETP		NA			
							Deep Burial		10 fr*20 fr*6 ft depth engineered secured land fill			
12	M/s. Environ Bio Waste Systems (India) Pvt Ltd, Uthokottai Taluk, Tiruvallur District.	Yet to be commissioned	-	-	-		Incinerator					
							Autoclave					
							Hydroclave					
							Microwave					
							Shredder					
							ETP					
							Deep Burial					
	Total		**6246**	**14387**	**38933**							

Sourcece : Tamil Nadu Pollution Control Board 2012-2013

4.1.3 Risks due to improper Handling of Bio-Medical wastes

There are many risks that can arise due to improper handling of Bio-medical Wastes**,** such as:

--Occupational exposure to blood can result from:

• Percutaneous injury (needle stick or other sharps injury)

•Injury due to splash of blood or other body fluids into the eyes, nose or mouth

--Diseases (Blood – Borne) that can spread through contact:

• HIV

• Tuberculosis

4.2 E-Waste

E-waste or "Electronic waste" may be defined as discarded computers, office electronic equipment, electronic entertainment devices, mobile phones, television sets, refrigerators and other electronic equipment . E-waste contains a large number of hazardous compounds and has to be disposed properly. Some of the substances found in e-waste include:

In large quantities include epoxy resins, fiberglass, PCBs, PVC (polyvinyl chlorides), thermosetting plastics, lead, tin, copper, silicon, beryllium, carbon, iron and aluminum. Some substances found in small amounts include cadmium, mercury, and thallium. Elements found in trace amounts include americium, antimony, arsenic, barium, bismuth, boron, cobalt, europium, gallium, germanium, gold, indium, lithium, manganese, nickel, niobium, palladium, platinum, rhodium, ruthenium, selenium, silver, tantalum. Almost all electronics contain lead and tin (as solder) and copper (as wire and printed circuit board tracks).

4.2.1 Sources

Figure 4.3 Sources of E-Wastes

The above diagram shows a list of E-waste sources.

E-wastes (Management and Handling) Rules; 2011

The **E-waste (Management and Handling) Rules;** 2011 provide the rules on how e-waste should be managed, handled, Procedure for storage, transportation of E-wastes and duties of the respective authorities(State Pollution Control Board, CPCB)

4.2.2 Inventory in Tamil Nadu

The amount of E-wastes generated in Tamil Nadu is mainly from the urban areas. A total of 13486.2 Tonnes was generated in the year 2011. .

Table 4. 3 E- Wastes Generated in Tamil Nadu in the Year 2011

	No. of Tonnes (2011)
Tamil Nadu	**13486.2**

Source: Research unit (Larrdis) Rajya Sabha Secretariat, June 2011

4.2.3 Environmental impacts due to E-Wastes

Table. 4.4 Environmental impact of the processing of different electronic waste components

E-Waste Components	**Process Used**	**Potential Environmental Hazard**
Cathode ray tubes (used in TVs, computer monitors, ATM, video cameras, and more)	Breaking and dumping	Possibility of Lead, barium and other heavy metals leaching into the ground water.
Printed circuit board (chips and other electronic components are placed)	De-soldering and removal of computer chips; open burning and acid baths to remove final metals after chips are removed.	Air emissions due to burning as well as discharge tin, lead, brominated dioxin, beryllium cadmium, and mercury into rivers.
Chips and other gold plated components	Chemical stripping using nitric and hydrochloric acid and burning of chips	Hydrocarbons, heavy metals, brominated substances if discharged directly into rivers will cause harm to the flora and fauna. Tin and lead will contaminate the surface and groundwater. Air emissions due to heavy metals and hydrocarbons can cause harm to Humans and the surrounding
Plastics from printers, keyboards, monitors, etc.	Shredding and low temperature melting to reuse	Air Emissions of brominated dioxins , heavy metals and hydrocarbons
Computer wires	Open burning and stripping to remove copper	Hydrocarbon ashes released into air, water and soil.

4.3 Plastic Wastes

A plastic material consists of a range of synthetic or semi-synthetic organic solids that are moldable. Plastics are mainly organic polymers of high molecular mass, they are usually synthetic. They are most commonly derived from petrochemicals. The use of plastic is wide (from toys, bags, plates etc) they are used in many industries as both for different products and for packaging material. The accumulation of Plastic wastes leads to plastic pollution. The prominence of plastic pollution is correlated with plastics being both inexpensive and durable has led to high levels of plastics used by humans.

Plastic pollution occurs in many forms, including littering, marine debris (plastic wastes that have been dumped into a lake, sea, ocean, or waterway), plastic particle water pollution and plastic netting. One of the main reasons for so much plastic to be dumped is because a large percentage of plastic produced each year is used for making single-use, disposable packaging products or items which will get permanently thrown within one year.

The plastic materials are categorized in seven types based on properties and applications. The universally accepted standards marking code has been developed to help consumers identify and sort the main types of plastic. It will also help in identifying whether the material used on the end product is virgin, recycled or a blend of virgin and recycled. The symbols defined by society of the Plastic Industry (SPI) USA and available in the IS 14534:1998 of BIS are as follows:

Codes	Properties	Packaging Applications	Recycled Products
1 PET	Clarity, strength, toughness, barrier to gas and moisture, resistance to heat	Packaged drinking bottles and soft drink bottles	Fiber fill for sleeping bags, carpet fibers, ropes, pillows etc
2 HDPE	Stiffness, strength, toughness, resistance to chemicals and moisture, permeability to gas, ease of processing	Raffia bags, knitted fabrics, water, gas and sewer pipes, small volume bottles to large barrels, house wares, storage bins, caps and closures, shopping bags, etc.	Flower pots, trash cans, traffic cones, detergent bottles, soap cases, other household items, etc.
3 V	Versatility, clarity, eases of blending, strength, toughness, resistance to grease, oil and chemicals.	pharmaceutical tablet packaging, potable water pipes and irrigation pipes and fittings, door and window profiles, cables, floorings, medical products like blood bags, footwear, etc.	Footwear, irrigation and other drainage pipes, mats, etc.

Codes	Properties	Packaging Applications	Recycled Products
4 LDPE	Ease of processing, strength, toughness, flexibility, ease of sealing, barrier to moisture.	Wide width films, agriculture films and pipes, heavy duty bags, shrink films, cable insulation and sheathing, extrusion coating, liquid packaging, etc.	Grocery bags, shelter films, household items, etc.
5 PP	Strength, toughness, resistance to heat, chemicals, grease and oil, versatile, barrier to moisture.	Raffia, monofilaments, strapping, automobile batteries and automobile components, luggage and furniture, combs, ball pens, injection syringe, etc.	Plastic lumber, household goods, luggage, etc.
6 PS	Versatility, insulation, clarity, easily formed	Disposable cups, packaging materials, meat trays, audio visual cassettes, etc.	Plastic lumber, cassette tape boxes, flower pots, etc.
7 OTHER	Dependent on resin or combination of resins	The category includes other plastics like nylon, ABS, Poly Acetals, Polycarbonate,	Recycling of these high value plastics are special in nature.

Source: IS 14535: 1998 & ICPE Newsletter, Vol. 6, Issue 2, Apr- Jan 2005.

4.3.1 Sources

Plastics are used to manufacture everyday products such as containers, toys, furniture, packaging material etc. Plastics make up almost 14 percent of the municipal solid waste. The largest amount of plastics is found in containers and packaging (e.g. bottles, lids), they also are found in durable products (e.g. appliances, furniture) and nondurable goods (e.g., diapers, cups and utensils, medical devices).

Figure 4.4 Image showing Plastic bottles collected from Municipal Solid Waste

Plastic waste (management and handling) rules, 2011

Some of the salient features of the new Rules are:-

- Use of plastic materials in sachets for storing, packing or selling gutkha, tobacco and pan masala has been banned.
- Under the new Rules, foodstuffs will not be allowed to be packed in recycled plastics or compostable plastics.
- Recycled carry bags shall conform to specific BIS standards.
- Plastic carry bags shall either be white or only with those pigments and colourants which are in conformity with the bar prescribed by the Bureau of Indian Standards (BIS). This shall apply expressly for pigments and colourants to be used in plastic products which come in contact with foodstuffs, pharmaceuticals and drinking water.
- Plastic carry bags shall not be less than 40 microns in thickness. Under the earlier Rules, the minimum thickness was 20 microns. Several State Governments in the meanwhile, had stipulated varying minimum thickness. It is now expected that 40 microns norms will become the uniform standard to be followed across the country.
- The minimum size (of 8x12 inches) for the plastic carry bags prescribed under the earlier Rules has been dispensed with.
- Carry bags can be made from compostable plastics provided they conform to BIS standards.

One of the major provisions under the new Rules is the explicit recognition of the role of waste pickers. The new Rules require the municipal authority to constructively engage agencies or groups working in waste management including these waste pickers. This is the very first time that such a special dispensation has been made.

Table 4. 5 District wise list of plastic waste generated and its disposal and action taken to create awareness on plastic waste management for Tamil Nadu 2013

S. No.	District	Estimated plastic waste generation TPA	Qty Road Construct	Open Dump	Surprise checks(local Body)- 40	Collection centers	Awareness programs
1.	Chennai	116212	1100	104112	23	15	
2.	Coimbatore	2275.5	1.53		205		87
3.	Cuddalore	3317.85	1098.9	915.75	1097	29	70
4.	Dindigul	201.56	120	81 .56		22	2
5.	Erode	6326.6	270.716	6059.8	234	6	31
6.	Dharmapuri & Krishnagiri	1100	476.7	609.39	76		
7.	Karur						
8.	Madurai	4403.29	2593.48	1809.8	195	13	
9.	Kanchipuram	1581	251.08	1794.5	66	4	
10.	Nagapatinam	847.437	46.95	800.49	279	10	19
11.	Namakkal	7.28		7.28	312		Conducted
12.	Thiruvarur	502.434	78.434	424	381	7	15
13.	Kanyakumari	457.65	157.54	299.11	5052	153	
14.	Ooty	502.172	3.345	498.83		50	
15.	Pudukkottai	412.14	334.1	17.5	139	32	
16.	Salem	2463	1514.94			38	
17.	Ramnad	1926.3	87.95		341	1	15
18.	Sivagangai	908.55	121.125		399	5	25
19.	Thanjavur	2972.143	17.07	2312.5	614	19	
20.	Theni	2076.935	797.32		Regularly	28	
21.	Thoothukudi	1512.55	28	62	168	3	
22.	Tirunelveli	791	63	650	611	10	
23.	Tiruppur	819	109	710	302	13	
24.	Tiruvallur	22,062		22,062			4
25.	Tiruvannamalai	4315	10	4305	570	32	
26.	Trichy	12595.33	111.46	12484	523	46	547
27.	Vellore	6701.38	13.482	6687.4	54	13	38
28.	Virudhunagar	1571.31	40.096	1487.5	626		324
29.	Villupuram	3975		3975			
	Total	**223111**	**6616.372**	**63223**	**10709**	**480**	**1001**

Source: Tamil Nadu Pollution Control Board 2013

4.3.3 Environmental Impacts Due To Plastic Wastes

Land

When Plastic wastes are dumped in the Landfill, they undergo very slow degradation due to the action of micro-organisms. During this process plastic is broken down into some hazardous petrochemicals. When rain or water falls on the land fill sites, this will lead to the Leaching of these compounds into the ground water, causing ground water contamination.

Effects on animals

Plastic pollution has the potential to poison animals, which can in turn affect human food supplies. Some marine species, such as sea turtles, seagulls have been found to contain large proportions of plastics in their stomach. Many species, including invertebrates, have been reported to have either ingested plastic. When a species gets entangled in plastic, its movement is seriously reduced. Being entangled usually results in death.

Effects on humans

Some of the chemicals used in plastic production can cause dermatitis upon contact with human skin.

4.4 Hazardous Waste

Hazardous wastes, which may be in solid, liquid or gaseous form, may cause danger to health or environment, either alone or when in contact with other waste. These wastes are mostly from industries. . Hazardous wastes can be identified by the characteristics that they exhibit viz., **ignitability, corrosivity, reactivity, or toxicity.**

Table 4.6 General Characteristics of Hazardous wastes

S.No	Hazardous characteristics	Potential Hazards on living animals / Environment
1.	Flammable/explosive	This type of waste may cause damage to the surrounding by producing harmful gases at high temperature and pressure or by causing fire hazards
2.	Oxidizing	Type of wastes that may yield oxygen and thereby cause or contribute to the combustion of other materials
3.	Poisonous(Acute)	These wastes have high potential to cause death , serious injury or harm to health if swallowed , inhaled or contact by skin
4.	Infectious substances	Hazardous wastes containing micro-organisms and their toxins and responsible for diseases in animals or humans
5.	Corrosives	These wastes are chemically active and may cause severe damage to the flora and fauna , or to the other material by direct contact with them
6.	Eco-Toxic	These wastes may present immediate or delayed adverse impacts to the environment ny means of bioaccumulation and / or toxic effect upon biotic systems
7.	Organic Peroxides	These are organic waste containing bivalent –O-O structure and may undergo exothermic self- accelerating decomposition
8.	Toxic(Delayed or Chronic)	These wastes , if inhaled or ingested or if they penetrate the skin , may cause delayed or chronic effects including carcinogenicity

4.4.1 Sources

Hazardous wastes in India can be categorized broadly into two categories, viz., i) hazardous wastes generated from various industries, and ii) hazardous wastes imported into or exported to India. Hazardous wastes include used oil, battery wastes and other non- ferrous wastes like zinc, lead . Industrial sectors , automobiles, transformer, capacitor generate used oil etc. Used oil contains high levels of various heavy metals like lead, cadmium, arsenic and chromium etc. It also contains contaminants such as chlorinated solvents, polychlorinated bi-phenyls and other carcinogens. Effluent sludge from highly polluting industries is also considered as Hazardous wastes. A list of the different process giving hazardous wastes as classified by the **Hazardous Waste Management & Handling Rules**, **2008** is given in the table below.

Table 4.7 List of Process generating Hazardous wastes

S.No.	Process	Hazardous Wastes*
1.	Petrochemical processes and pyrolitic operations	1.1 Furnace/ reactor residue and debris 1.2 Tarry residues 1.3 Oily sludge emulsion 1.4 Organic residues 1.5 Residues from alkali wash of fuels 1.6 Still bottoms from distillation process 1.7 Spent catalyst and molecular sieves 1.8 Slop oil from waste water
2.	Drilling operation for oil and gas production	2.1 Drill cuttings containing oil 2.2 Sludge containing oil 2.3 Drilling mud and other drilling wastes
3.	Cleaning, emptying and maintenance of petroleum oil storage tanks including ships	3.1 Oil-containing cargo residue, washing water and sludge 3.2 Chemical- containing cargo residue and sludge 3.3 Sludge and filters contaminated with oil 3.4 Ballast water containing oil from ships.
4.	Petroleum refining/ re-processing of used oil/recycling of waste oil	4.1 Oily sludge / emulsion 4.2 Spent catalyst 4.3 Slop oil 4.4 Organic residues from process 4.5 Spent clay containing oil
5.	Industrial operations using mineral/synthetic oil as lubricant in hydraulic system or other applications	5.1 Used/ Spent oil 5.2 Wastes/residues containing oil
6.	Secondary production and/ or industrial use of zinc	6.1 Sludge and filter press cake arising out of production of Zinc Sulfate and other Zinc Compounds. 6.2 Zinc fines/dust/ash/skimmings(dispersible form) 6.3 Other residues from processing of Zinc ash/skimmings

		6.4 Flue gas dust and other particulates
7.	Primary production of Zinc/lead /copper and other non-ferrous metals except aluminum	7.1 Flue gas dust roasting 7.2 Process residues 7.3 Arsenic-bearing sludge 7.4 Non-ferrous metal bearing sludge and residue. 7.5 Sludge from scrubbers
8.	Secondary production copper	8.1 Spent electrolytic solutions 8.2 Sludges and filter cakes 8.3 Flue gas dust and other particulates.
9.	Secondary production of lead	9.1 Lead bearing residues 9.2 Lead ash/particulate from flue gas
10.	Production and/or industrial use of cadmium and arsenic and their compounds	10.1 Residues containing cadmium and arsenic
11.	Production of Primary and Secondary aluminum	11.1 Sludges from OFF-gas treatment 11.2 Cathode residues including pot lining waste 11.3 Tar containing waste 11.4 Flue gas dust and other particulates 11.5 wastes from treatment of salt slag's and black drosses
12.	Metal surface treatment, such as etching, staining, polishing, galvanizing, cleaning, degreasing, plating, etc.,	12.1 Acid residues 12.2 Alkali residues 12.3 Spent bath/sludge containing sulfide, cyanide and toxic metals 12.4 Sludge from bath containing organic solvents 12.5 Phosphate sludge 12.6 sludge from staining bath 12.7 Copper etching residues 12.8 Planting metal sludge.
13.	Production of iron and steel including other ferrous alloys(electric furnaces; steel rolling and finishing mills ;Coke oven and byproduct plant)	13.1 Sludge from acid recovery unit 13.2 Benzoic acid sludge 13.3 decanter tank tar sludge
14.	Hardening of Steel	14.1 Cyanide- Nitrate-or Nitrite- Containing Sludge 14.2 Spent hardening salt
15.	Production of Asbestos or Asbestos -containing materials	15.1 Asbestos -containing residues 15.2 Discarded asbestos 15.3 Dust or particulates from exhaust gas treatment
16.	Production of Caustic soda and Chlorine	16.1 Mercury bearing Sludge 16.2 Residue/Sludges and filter cakes 16.3 Brain sludge containing Mercury
17.	Production of mineral acids	17.1 residues, dust or filter cakes 17.2 spent catalyst
18.	Production of Nitrogenous and Complex Fertilizers	18.1 Spent catalyst 18.2 Spent Carbon 18.3 Sludge / residue containing arsenic 18.4 Chromium sludge from water cooling towers
19.	Production of phenol	19.1 residues/Sludge containing phenol

20.	Production and /or industrial use of solvents	20.1 Contaminated aromatic, aliphatic or naphthalic solvents may or may not be fit for peruse 20.2 Spent solvents20.3 Distillation residues
21.	Production and /or industrial use of paints , pigments, Lacquers, varnishes , plastics and inks	21.1 Process waste, residues and sludges 21.2 Fillers residuals
22.	Production of Plastic raw materials	22.1 Residues of additives used in plastics manufacture like dye stuffs, stabilizers, flames retarders, etc., 22.2 Residues and waste of plasticizers 22.3 Residues from Vinyl chloride monomer production 22.4 Residues from Acrylonitrile production 22.5 Non polymerized residues
23.	Production and /or industrial use of glues, cements, adhesives and resins	23.1 Waste/residues (not made with vegetable or animal materials)
24.	Production of canvas and textiles	24.1 Chemical residues
25.	Industrial production and formulation of wood preservatives	25.1 Chemical residues 25.2 Residues from wood alkali bath
26.	Production/ Industrial use of synthetic dyes, dye-intermediates and pigments	26.1 Process waste sludge/ residues containing acid or other toxic metals or organic complexes 26.2 Dust from air filtration system
27.	Production of Organo-silicon components	27.1 Process residues
28.	Production or formulation of drugs or pharmaceuticals and Healthcare products	28.1 Process residues and waste, 28.2 spent catalyst or Spent carbon 28.3 Off specification products 28.4 date expire, Discarded and Off specification drugs or medicines 28.5 Spent organic solvents
29.	Production and formulation of pesticides including stalk-piles	29.1 Process waste or residues 29.2 Chemical sludge containing residual pesticides 29.3 Date expire and off specification pesticides
30.	Leather tanneries	30.1 Chromium bearing residues and sludge
31.	Electronic waste	31.1 Process residues and waste 31.2 Spent etching Chemicals and solvents
32.	Pulp and Paper waste	32.1 Spent chemicals 32.2 Corrosive waste arising from strong acid and bases 32.3 Process sludge containing adsorbable organic halides[AOx]
33.	Disposal of barrels ,containers used for handling of hazardous waste chemicals	33.1 Chemical- containing residues arising from decontamination 33.2 Sludge from treatment of waste water arising out of cleaning disposal of barrels and containers 33.3 Discarded containers/barrels/liners contaminated with hazardous waste or chemicals
34.	Purification and treatment of exhaust air, water and waste water from the processes in this Schedule in common industrial	34.1 Flue gas cleaning residues 34.2 Spent ion exchange vessel containing toxic chemicals 34.3 Chemical sluge from waste water treatment

	effluent treatment plants	34.4 Oil and grease residues 34.5 Chromium sludge from cleaning water
35.	Purification process for organic compounds or solvents	35.1 Filters and filter material which ve organic liquids in them eg. Mineral oil, synthetic oil and organic chlorine compounds 35.2 Spent catalyst 35.3 Spent carbon
36.	Hazardous waste treatment process eg. Incineration distillation, separation and concentration techniques	36.1 Sludge from wet scrubbers 36.2 Ash from incineration of Hazardous waste, flue gas cleaning residues 36.3 Spent acid from batteries 36.4 Distillation residues from contaminated organic solvents.

Inventorisation of hazardous wastes generating units and quantification of wastes generated in India are being done by the respective State Pollution Control Board. Depending on the physical and chemical characteristics of hazardous wastes, these may be categorized into three categories, viz., recyclable, incinerable and landfill.

The hazardous wastes may be categorized :

As recyclable when resource recovery is possible by reprocessing the waste, as incinerable when it is possible to incinerate the wastes for destruction and energy recovery, and As landfill waste when this is not suitable either for resource or energy recovery, but suitable for dumping with or without any treatment.

4.4.2 Inventory In Tamil Nadu

In Tamil Nadu the inventory of Hazardous Waste generating units was 2210 in the year 2004, in 2006, the total number of HW generating industries was inventoried to be 2422 and in 2007, the total number of HW generating industries is 2480 as on 2007. The District-Wise Break-up is given in table 4.8 .

Table 4.8 Hazardous Waste Generation in Tamil Nadu-2007								
Sl.No.	District	No. of Industries	HW generation in MTA as per Schedule 1	HW generation in MTA as per Schedule 1	Total Quantity	Quantity of HW in MTA Land files	Quantity of HW in MTA Recyclable	Quantity of HW in MTA Incinerable
1	Chennai	94	1140.886	1070.996	1705.085			1705.085
2	Coimbatore	110	6857.112	6469.4	9202			9202
3	Cuddalore	43	9202.538	6571.67	8774.85			8774.85
4	Dindigul	45	6141.955	9589.58	13047.16			13047.16
5	Erode	364	17781.27	2749.56	3806.83			3806.83
6	Osur	83	12555.156	11219.06	18084.93			18084.93
7	Kancheepuram	249	22025.356	10281.72	13804.95			13804.95
8	Kanniyakumari	16	537.414	538.25	538.294			538.294
9	Karur	61	6396.677	219.02	11246.34			11246.34
10	Madurai	108	5832.195	3916	4927.63			4927.63
11	Nagapattinam	18	531.254	522.796	522.796			522.796
12	Namakkal	127	4094.75	2283.01	4083.65			4083.65
13	Oty	12	682.034	99.98	910.106			910.106
14	Pudukottai	35	614.634	3134.47	3238.3			3238.3
15	Salam	129	16262.851	6901.32	17576.08			17576.08
16	Sivagangai	19	334.451	1037.92	1037.92			1037.92
17	Thanjavur	27	111.996	299.617	301.996			301.996
18	Theni	12	1039.252					
19	Thirunelveli	43	1479.855	24652.21	45357.17			45357.17
20	Thiruvallur	219	19384.962	453.384	453.384			453.384
21	Thiruvarur	11	459.08	6749.66	38655.96			38655.96
22	Thoothukudi	41	37696.883	3569	36766			36766
23	Tiruppur	267	42947.53	875.5	35980.32			35980.32
24	Trichy	77	5131.679	4959.058	5991.171			5991.171
25	Vaniyambadi	74	14872.6	0.96	16680.76			16680.76
26	Vellore	106	8965.99	5839.299	13552.27			13552.27
27	Villupuram	18	2464.31	2878.79	3132.31			3132.31
28	Virudhunagar	72	3487.179	16441.44	19147.99			19147.99
	Total	**2480**	**249031.76**	**6249.8**	**255282**			**10714.3**

Source : TNPCB,

Hazardous Waste Management

Hazardous wastes, can be managed by recycling, incineration or land filling. The hazardous wastes may be categorized as recyclable when resource recovery is possible by reprocessing the waste, as incinerable when it is possible to incinerate the wastes for destruction and energy recovery, and as landfill waste when this is not suitable either for resource or energy recovery, but suitable for dumping with or without any treatment.

Effluent Sludge is generated after Effluent treatment is done in an ETP. The Sludge mostly contains a complex mixture of salts. Recovery of products from sludge is an expensive and difficult process. Ranipet ETP is one such Effluent Treatment Plant where the salts are recovered from the sludge.

Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules, 2008.
These rules provide details of how hazardous wastes should be handled and treated.

4.4.3 Environmental Impacts due to Hazardous Wastes

Major Environmental impacts include contamination of Ground Water/ Drinking Water sources by improper disposal of Hazardous Wastes .

Land degradation is also caused due to continuous dumping of Hazardous wastes on Land.

Table 4.9 Health Impacts Due to Hazardous Wastes

Hazardous Waste	Source	Health effects
Heavy metals		
Arsenic	Mining, non anthropogenic geo-chemical formation	Carcinogenic,cardiac, anemia,
Cadmium	Mining, fertilizer industry, battery waste	Carcinogenic, damage to livers and kidneys, chronic obstructive pulmonary diseases, cardiovascular and skeletal disorders.
Chromium	Mining areas, Tanneries	Kidney damage, skin diseases, acute tubular damage.
Lead	Lead acid battery smelters	Lead poisoning, neurotoxic, mental impairment in children, damage to brain, kidney and liver
Manganese	Mining areas	Respiratory disease, neuropsychiatric disorder
Mercury	Chlor-alkali industries, health care institutes	Hg poisoning affects human brain, central nervous system, kidneys and liver. High Hg exposure causes vision, speech and hearing impairment. My lead to death
Nickel	Mining, metal refining	Lung and nasal cancer, damage

		to gastrointestinal system, cerebral edema, respiratory failure
Hydrocarbons		
Benzene	Petrochemical industries, solvents	Headaches, nausea, leukemia, damage to bone marrow.
Vinyl chloride	Plastics	Carcinogenic (liver and lung cancer), depression of central system, embroyotoxic.
Pesticides	Insecticides	Cancers, genetic damage, still births, immune system disturbances, embryo damage
Organic Chemicals		
Dioxins	Waste incineration, herbicides	Cancer, birth defects, skin diseases
PCBs	Fluorescent lights, E-waste, Hydraulic fluid	Skin damage, possibly carcinogenic, gastro- intestinal damage.

4.5 Municipal Solid Wastes

Municipal solid waste (MSW), commonly known as trash or rubbish is a waste type consisting of everyday items that are discarded by the public.

4.5.1 Components of Municipal solid waste

The main components of Municipal solid waste include:

- Biodegradable waste: food and kitchen waste, green waste, paper (can also be recycled).
- Recyclable material:paper, glass, bottles, cans, metals, certain plastics, fabrics, clothes, batteries etc.
- Inert waste: construction and demolition waste, dirt, rocks, debris.
- Electrical and electronic waste - electrical appliances, TVs, computers, screens, etc.
- Composite wastes: waste clothing, Tetra Packs, waste plastics such as toys.
- Hazardous waste including most paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and containers
- Toxic waste including pesticide, herbicides, fungicides
- Medical waste.

Figure 4.4 Municipal Solid Waste in a Landfill Site

4.5.2 Inventory of Municipal Solid Wastes in Tamil Nadu

Table 4.10 Municipal Solid Waste Generation (MT/day) in the state of Tamil Nadu- 2013

Compliance status of MSW (M&H) Rules 2008 – District wise					
Sl. No.	**DISTRICT**	**MSW Generated (Tonnes per Day)**			
		Corporation (C)	**Municipality (M)**	**Town Panchayat (TP)**	**Total (TPD)**
1.	Chennai	4800			4800
2.	Coimbatore	850	91	160	1101
3.	Cuddalore		196	15	210
4.	Dindigul		211	61	272
5.	Erode	296	76	159	531
6.	Dharmapuri & Krishnagiri		155	40	196
7.	Karur		139	14	153
8.	Madurai	658	50	29	737
9.	Kanchipuram		442	363	805
10.	Nagapatinam		87	8	95
11.	Namakkal		149	39	188
12.	Thiruvarur		52	4	56
13.	Kanyakumari		27	42	70
14.	Ooty		68	7	75
15.	Pudukkottai		48	11	59
16.	Salem	350	73	120	543
17.	Ramnad		61	15	76

18.	Thanjavur		179	22	201
19.	Theni		0	82	82
20.	Thoothukudi	170	43	30	243
21.	Tirunelveli	150	55	37	242
22.	Tiruppur	500	106	1,108	1,714
23.	Tiruvallur		241	26	267
24.	Tiruvannamalai		132	199	331
25.	Trichy, Ariyalur & Perambalur	405	108	40	553
26.	Vellore	180	265	41	487
27.	Virudhunagar		191	10	201
28.	Villupuram		113	45	159
Total		**8359**	**3433**	**2741**	**14,532**

Corporation : 8359 MT/day - 57.52 %
Municipalities : 3433 MT/day - 23.62 %
Town Panchayat : 2741 MT/day - 18.86 %
Total : 14532 MT/day - 100 %

Chennai corporation Generates the maximum of 4800 Tonnes per Day.

Municipal Solid Wastes (Management and Handling) Rules,2000

The Municipal Solid Wastes (Management and Handling) Rules, 2000 give the details of how municipal solid waste should be Managed, Transported, handled and disposed off. The following is the implementation schedule for MSW for any municipality of facility operator.

Table 4.11 Municipal Solid Waste Compliance Implementation Schedule

Serial No.	Compliance Criteria
1.	Setting up of waste processing and disposal facilities
2.	Monitoring the performance of waste processing and disposal facilities
3.	Improvement of existing landfill sites as per provisions of these rules
4.	Identification of landfill sites for future use and making site (s) ready for operation

Table 4.12 Management of Municipal Solid Wastes

S.no	Parameters	Compliance criteria
1.	**Collection of municipal solid wastes**	1. Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely :- i. Organising house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels); ii. Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas; iii. Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes; iv. Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose; v. Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerised carts or other small vehicles; vi. Horticlutural and construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws; vii. Waste (garbage, dry leaves) shall not be burnt; viii. Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws. 2. The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town. 3. It shall be the responsibility of generator of wastes to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system to be notified by the municipal authority as per para 1(2) of this Schedule.
2.	Segregation of municipal solid wastes	In order to encourage the citizens, municipal authority shall organise awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials. The municipal authority shall undertake phased programme to

		ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare associations and non-governmental organizations.
3.	**Storage of municipal solid wastes**	Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely :- i. Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users; ii. Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly; iii. Storage facilities or ﷿bins﷿ shall have ﷿easy to operate﷿ design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be printed white and those for storage of other wastes shall be printed black; iv. Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.
4.	**Transportation of municipal solid wastes**	Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:- i. The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing; ii. Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.

5.	**Processing of municipal solid wastes**	Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely:- (i) The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. It shall be ensured that compost or any other end product shall comply with standards as specified in Schedule-IV; ii. Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletisation can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorisation.
6.	**Disposal of municipal solid wastes**	Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms.

The Rules also provide specific details of how land fill sites are selected.

Energy generation

Municipal solid waste can be used to generate energy. Several technologies have been developed that make the processing of MSW for energy generation cleaner and economical, including landfill gas capture, combustion and gasification. Older waste incineration plants emitted high levels of pollutants, although recent new technologies have significantly reduced this concern.

4.5.3 Environmental Impacts Due to Municipal Solid Wastes

Air Pollution

Burning of Municipal Solid Wastes produces various compounds that are toxic to the environment that include nitrogen oxides, volatile organic compounds, carbon monoxide, and particle pollution. Nitrogen oxides, or NOx, is partially responsible for acid rain and contribute to global warming and ozone depletion. Volatile organic compounds, are carbon-based compounds that undergo

photochemical reactions with sunlight and are released into the atmosphere. They end up forming ozone in the atmosphere.

Carbon monoxide, chemically reacts with sunlight to create ozone, which is a harmful gas. CO production can significantly impact ambient air quality. CO is also a greenhouse gas. Particle pollution, also known as particulate matter, or PM, refers to the fine particles that produce smoke, which leads to reduced visibility and haze. Landfills emit a lot of methane every year and other gases like toluene and methylene chloride, Methane is a powerful greenhouse gas and is present in large quantities in Land fills. In addition to its effect in the ozone layer, methane is also a combustible gas that is responsible for various explosions in and around landfills.

Water Quality/Contamination:

MSW has a significant impact on surface and groundwater sources. Leachate of pollutants into ground water is a common problem around Land fill area . This could be minimized through proper sealing measures.

Natural Habitat Degradation

As land is claimed for landfills, it is no longer usable to many plants and wildlife.

5. Cleaner Technologies Used in different industries

The TNPCB is involved in promoting a holistic approach of environment protection by cleaner technology options more than mere end – of – pipe treatment. With active support and encouragement from the board, the industrial units in Tamilnadu have switched over to cleaner technologies such as adoption of membrane cell instead of mercury cell in caustic soda manufacturing, adoption of double conversion and double absorption technology in sulphuric acid manufacturing, gas carburizing instead of cyanide salt in heat treatment and cyanide free electroplating. Pulp and paper industries are encouraged to go in for elemental chlorine free bleaching to reduce the formation of organo-chlorides including dioxins. Industries consuming ozone-depleting substances are systematically changing to environment friendly compounds. Tanneries adopt desalting, reuse of lime and chrome recovery system so as to reduce the pollution load in the effluent.

Waste Minimization

With the adoption of cleaner technologies there has been progress in waste recovery and waste minimization. Examples include recovery of materials such as chrome from tannery effluent and ammonia from fertilizers. Distilleries have been insisted to provide zero discharge system and distilleries have gone for bio composting of their effluents with press mud of sugar factories for

achieving zero discharge of trade effluent and 5 distilleries have established concentration cum incineration system to dispose spent wash effluent and achieved zero discharge of trade effluent.

Energy conservation

As a measure for fuel conservation and recovery, all the distilleries are recovering methane gas from their spent wash through anaerobic digestion. Major sugar factories have installed co-generation power plant. The sago units recovery methane gas from their trade effluent through anaerobic digestion. In activated carbon process, the waste heat is recovered and used at boiler section. Other industrial units are encouraged to use less energy and it is being audited through the environmental statement of the unit.

6. Conclusion

Data collected from various organizations and Departments of Government of Tamil Nadu, reveals that there is pollution in the environment in various districts of the State.

Population explosion, urbanization and Industrialization in the recent past has led to complex Environmental Pollution in Tamil Nadu. It was our belief that utilization of control equipment, establishment of Effluent treatment plants, Sewage Treatment Plants are enough to control emissions and for safe discharge of effluent into receptors like rivers, lakes, streams etc. But the real solution lies in avoiding the sources of pollution by adopting measures like resource recovery and cleaner technological processes for effective way of tackling the Environmental issues and problems. Process development to use less polluting raw materials is a long term preventive action. Recovery of Chromium from Tannery Effluent is a classic example of resource conservation.

Due to the compulsion on alternative energy sources, industries which produce hot waste gases have opted for the generation of power. This resulted in reducing the usage of coal and greenhouse gases.

Replacing hazardous substances with eco-friendly substances will not only reduce the pollution load , but also reduce the consumption of raw materials .

Environmental concerns due to generation of large quantity of municipal solid wastes, hazardous wastes , E-wastes , Bio-medical Wastes , Plastic Wastes from residential units, industries , institutions , Health care facilities , commercial establishments and service providers are posing Environmental pollution to a larger extent affecting land , water , air and the environment which leads to degradation of resources and loss of ecosystem depriving cleaner environment for future generation .

Sewage collection, treatment and solid waste management remains extensively unsolved in major cities and towns.

Transport is another sector that contributes to air pollution, specially in urban areas. A good action plan must be developed for traffic management in urban areas as the levels of pollution in the ambient air due to traffic is increasing at an alarming rate.

Many issues of environmental concern can be solved by making all stake holders to understand the problems in greater depth, so that it is possible to find appropriate solutions.

Industries, waste processors, communities, NGO's and all other stake holders must contribute their might to solve Environmental problems in addition to Government and regulatory Authorities.

Whether, it is pollution from Industry or local body or transport activity, it is the basic knowledge of the stake holders in the field of the latest legislations, technology, standards and all connected issues which will help for effective implementation of the Environment protection programmes.