CHAPTER – II
INDUSTRY

2.0 INTRODUCTION

In Orissa, industrialization started shortly after independence. The oldest industries in the state were coal mines at Talcher and Ib Valley and paper mills at Choudwar and Brajrajnagar. Orissa appeared in the industrial map of the country after setting up of an integrated steel plant at Rourkela during second five years plan. Since the state is rich in mineral resources like bauxite, iron ore, lime stone, dolomite, chromite etc., more of mineral based industries came up. The history of industrialization in Orissa indicates that certain development processes initiated by the Government have accelerated industrialization in the state. For example, construction of Hirakud dam, the largest dam in the country, provided power at cheaper rate. This facilitated setting of an aluminium smelter at Hirakud, IDCOL cement at Bargarh, Rerolling Mill and Hirakud Industrial Works. The rice production in Hirakud command area increased significantly, facilitating phenomenal growth of rice mills in the area.

After nationalization of coal in 1975 and the national policy on energy sector many power plants were setup. As a result, the Talcher – Angul area has become the Power House of state. Development of Paradeep port has played a major role in industrial development in coastal area. Major industries in Orissa at the moment include huge integrated steel plant at Rourkela. NALCO, biggest aluminium smelter plant in the country, Oswal Fertilizer and Chemicals, the largest phosphatic fertilizer plant in the country, thermal power plants, pulp and paper industries, ferro alloys plants, cement plants etc.

2.1 PRESSURE

2.1.1 Factors Inducing Industrial Growth

The industries in the state are diverse and mostly depend upon the natural resources available in the state which include, Mineral, Forest, Water, Agricultural, Fisheries and Livestock, Water Resources.

The industries, which are closely linked to these resources, are located in the areas, close to the resource base. The industrial sectors are also accordingly distributed and have a very strong links with the resources available.

2.1.2 Mineral Resources

Orissa being a rich repository of major minerals like Coal, iron ore, Chromite ore, Manganese ore, Bauxite, Dolomite and lime stone etc., has become a prime destination for primary metallurgical industries. There is all likelihood that the state will become a major metal producer in the country.

2.1.3 Water Resources

Orissa is a coastal state and the eastern part has been formed by deltas of major rivers. Five rivers Mahanadi, Brahmani, Baitarani, Rushikulya and Subarnarekha with its numerous tributaries and distributaries are the major water resources.

Similarly the ground water availability is also very high in the state. Large part of ground water has remained unutilised. As such agriculture in the state largely depends upon surface water irrigation.

With availabilities of fresh water, and mineral resources Orissa could be the destination of water intensive industries like, thermal power, iron and steel, other primary metallurgical industries, paper and pulp etc.

2.1.4 Forest Resources

A Forest resource of Orissa is one of the richest in the country and also it supplies essential raw materials to the pulp and paper industries. The history of pulp and paper industries in the state dates back to 1940s with the setting up of Titaghar Paper Mills at Choudwar. Currently few large pulp and paper industries thrive on these forest resources.

2.1.5 Fishery Resources

Long coastline provides ample scope for marine exploitation. Industries associated with fishery like, fish processing plant and fish preservation plants have grown around the areas of fish product.

2.2 STATE

2.2.1 The industrial growth in the state has mostly taken place in the areas where raw materials, water and power are available. There are twelve industrially active zones/ areas (***Table 2.1***).

TABLE: 2.1
Major Industrial Areas/ Zones in Orissa

Sl.	Area	Type of Industries
1.	Rourkela-Rajgangpur	Iron and Steel, Sponge Iron, Cement, Secondary Steel Melting and Rolling Mill, Refractories, Chemicals and Engineering
2.	Ib Valley and Jharsuguda area	Thermal Power, Sponge Iron, Refractories and Coal Mines (Aluminium, Coal Washeries)
3.	Hirakud	Aluminium, Rolling Mill
4.	Talcher – Angul	Thermal Power, Aluminium, Coal Washeries, Ferro Alloys, Coal Mines
5.	Choudwar	Ferro Alloys, Thermal Power, Pulp and Paper, Coke Oven
6.	Balasore	Pulp and Paper, Ferro Alloys, Rubber Industries
7.	Chandikhol	Stone Crusher, Coke Oven
8.	Duburi	Integrated Steel, Ferro Alloys, Mineral Processing
9.	Paradeep	Fertilizer, Sea Food Processing, Petroleum Coke
10.	Khurda – Tapang	Stone Crusher
11.	Joda – Barbil	Pig Iron, Sponge Iron, Ferro Alloys, Iron Ore Crusher, Mineral Processing
12.	Rayagada	Pulp and Paper, Ferro Alloys

2.2.2 Currently 2754 industries in large, medium and small scale are operating in the state and a sectoral analysis of industries is presented in ***Table 2.2***.

TABLE: 2.2
Sector-Wise Industries Operating In Orissa

Sl. No.	Sector	No. of Industries			
		Large	Medium	Small	Total
1.	**Iron and Steel**				
	a. Integrated Iron and Steel	01	--	--	01
	b. Pig Iron	03	--	--	03
	c. Sponge Iron *	82	11	--	93
	d. Ferro Alloy Plant	07	03	01	11
	e. Secondary Steel Melting Like Induction Furnace etc. (Stand alone)	06	35	03	44

*Out of 93 Sponge iron plant 13 plants also have steel making facilities through DRI-IF/EAF route.

Sl. No.	Sector	No. of Industries			
		Large	Medium	Small	Total
	f. Rerolling Mills and Others and Reheating Furnace	--	20	21	41
2.	**Aluminium**	02	--	--	02
3.	**Pulp and Paper**	04	02	--	06
4.	**Sugar**	04	01	--	05
5.	**Fertilizer**	02	01	--	03
6.	**Thermal Power**	10	--	--	10
7.	**Cement**	07	02	01	10
8.	**Fermentation Industries**				
	a. Distilleries	02	--	01	03
	b. Breweries	02	--	--	02
	c. IMFL Bottling Plant	--	07	--	07
9.	**Chemical Industries**				
	a. Chloro Alkali	01	--	--	01
	b. Bulk Drugs	--	--	01	01
	c. Dye and Dye Intermediate	--	01	--	01
	d. Pesticides	--	01	02	03
10.	**Mineral Processing and Crushers**				
	a. Stone Crushers	01	05	918	924
	b. Chrome Ore Benefication	02	02	25	29
	c. Graphite Benefication	--	01	25	26
	d. Coal Washeries	01	03	--	04
	e. Iron Ore Crushers	04	97	75	176
	f. Mineral Sand Processing	01	--	--	01
	g. Alumina Refinery	01	--	--	01
	h. Coke Ovens	01	07	--	08
	i. Iron Ore Benefication	04	01	--	05
11.	**Food Processing and Allied Industries**				
	a. Rice Mills	--	32	218	250
	b. Sea Food Processing	--	12	08	20
	c. Beverages	01	08	01	10
	d. Flour Mills	--	17	19	36
	e. Dairy/Milk Chilling Centre	--	05	10	15
	f. Bakery	--	06	11	17
	g. Vegetable Oil /Edible Oil	--	13	07	20
12.	**Refractory/Bricks/Tiles**				
	a. Brick Kiln	--	--	231	231
	b. Refractory and Ceramics	02	22	08	32
	c. Fly Ash Bricks	--	--	15	15
13.	**Other Industries**				
	a. LPG Bottling and POL Depot	07	21	01	29
	b. Explosives	02	08	--	10
	c. Poly Propylene Products	--	31	12	43
	d. Poultry and Cattle Feed	--	10	06	16
	e. Industrial Gases (Oxygen and Acetylene)	--	12	03	15
	f. Engineering Industries	03	11	--	14

Sl. No.	Sector	No. of Industries			
		Large	Medium	Small	Total
	g. Automobile Service Stations	--	05	25	30
	h. Auto Tyre Manufacture	01	--	--	01
	i. Hotels	04	08	131	143
	j. Others like Conductors, Cold Storage, Masala Grinding Unit, Cotton Yarn, Aluminium Utensils, Concrete Sleepers, Glass Works, Plaster of Paris, Detergent, Granite Polishing, Mineral Water, Cotton Ginning, Vermicelli, Ice Cream	--	50	337	387
	TOTAL	**167**	**471**	**2116**	**2754**

(Large > 5 Crores, Medium 60 Lakhs to 5 Crores, Small < 60 Lakhs)

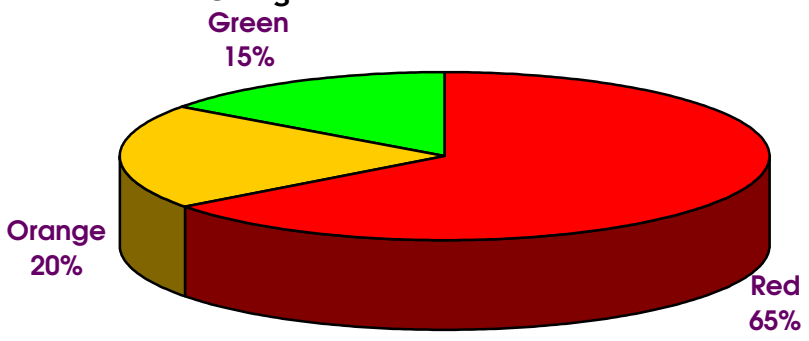
2.2.3 On the basis of pollution potential the Ministry of Environment of Forests, Government of India, have categorized as Red, Orange and Green. The industries in the state are accordingly categorized and presented in ***Table 2.3***.

TABLE: 2.3
Industry Categorisation

Sl. No.	Category	No. of Industries			
		Large	Medium	Small	Total
1.	Red	159	311	1309	1779
2.	Orange	08	104	449	561
3.	Green	0	56	358	414
TOTAL		**167**	**471**	**2116**	**2754**

It may be seen that most of the industries (65%) in the state being engaged in primary manufacturing activities fall within the red category. Categorywise industries are graphically presented in ***Figure 2.1***.

Figure 2.1
Categorisation of Industries



2.2.4 Central Pollution Control Board has identified 17 categories of industries as highly polluting type because of their high pollution potential. The break up of these highly polluting units are compiled in ***Table 2.4***. Out of 17 categories of industries identified by Central Pollution Control Board, Orissa has 12 categories of industries. Most of these industries are in large and medium sector.

TABLE: 2.4
17 Categories of Polluting Industries in Orissa

Sl. No.	Sector	No. of Industries			Total
		Large	Medium	Small	
1.	Thermal Power	10	--	--	10
2.	Integrated Iron and Steel	01	--	--	01
3.	Sponge Iron, Pig Iron and Steel	85	11	--	96
4.	Aluminium	02	--	--	02
5.	Cement	07	02	01	10
6.	Sugar	04	01	--	05
7.	Distillery	03	--	01	04
8.	Pesticide	--	01	02	03
9.	Chloro – Alkali	01	--	--	01
10.	Dye and Dye Intermediate	--	01	--	01
11.	Pulp and Paper	04	02	--	06
12.	Fertilizer	02	01	--	03
13.	Bulk Drug	--	--	01	01
	TOTAL	**119**	**19**	**05**	**143**

2.2.5 Further classification of industries have been done by Central Pollution Control Board as "Grossly Polluting Industries" based on their water pollution load. If the total BOD load from an industry exceeds 100 Kg/Day or if its effluent contains any hazardous chemicals, then the industry is categorized as Grossly Polluting Industry. Orissa has 18 such industries. Status of these industries operating in the state are compiled in ***Table 2.5***.

TABLE: 2.5
Grossly Polluting Industries in Orissa

Sl.	Name of the Industry	Public Sector/ Private Sector	Category	Effluent Recipient Place	Concerned River
1.	NALCO, CPP, Angul (Industrial effluent other than ash pond overflow, Ash Pond water is completely reused)	Public Sector	Thermal Power	Nandira Jhor	Brahmani
2.	NTPC, Kanhia (Industrial Effluent)	Public Sector	Thermal Power	Tikira River	Brahmani
2A.	NTPC, Kahnia (Ash pond overflow effluent)	Public Sector	Thermal Power	Tikira River	Brahmani
3.	TTPS (NTPC), Talcher (Industrial Effluent)	Public Sector	Thermal Power	Nandira Jhor	Brahmani

3A.	TTPS (NTPC), Talcher (Ash pond overflow effluent)	Public Sector	Thermal Power	Nandira Jhor	Brahmani
4.	Central Orissa Straw Board	Private Sector	Pulp and Paper	Mahanadi	Mahanadi
5.	Steel Township Rourkela	Public Sector	Urban Body	Koel River	Brahmani
6.	Fertilizer Plant, SAIL, Rourkela	Public Sector	Nitrogenous Fertilizer	Guradih Nallah	Brahmani
7.	ICCL (CPP), Choudwar, Cuttack	Private Sector	Thermal Power	Birupa	Birupa
8.	IDL Chemicals, Sonaparbat, Rourkela	Private Sector	Explosive	Balijodi Nallah	Brahmani
9.	Rourkela Steel Plant, Rourkela (Coke oven byproduct effluent)	Public Sector	Iron and Steel	Guradih Nallah	Brahmani
10.	Fertilizer Township Rourkela	Public Sector	Urban Body	--	Brahmani
11.	INDAL Smelter Hirakud (Domestic Effluent)	Private Sector	Aluminium Smelter	Mahanadi	Mahanadi
12.	Paradeep Phosphate Ltd.	Public Sector	Phosphatic Fertilizer	Atharbanki Creek	Bay of Bengal
13.	Ballarpur Industries (Sewa) Jeypore	Private Sector	Pulp and Paper	Nallah	Kolab
14.	Jayashree Chemicals Ltd., Ganjam	Private Sector	Chloro Alkali	Rushikulya	Rushikulya
15.	Emami Paper Mill Balgopalpur	Private Sector	Pulp and Paper	Swapna Nallah	Sona
16.	IFFCO Fertilizer Plant	Public Sector	Phosphatic Fertilizer	Creek	Mahanadi

2.2.6 The industries in the state thus vary widely in their size, activity and pollution potential. ***Table 2.6*** provides a view of sectoral annual production status in the state.

TABLE: 2.6
Sectoral Distribution of Industries in Orissa

Sl. No.	Major Industrial Sector	Unit/Year	Annual Capacity
1.	**Iron and Steel**		
	a. Integrated Iron and Steel	Ton x 10^6	2.7
	b. Pig Iron	Ton x 10^6	1.3
	c. Sponge Iron	Ton x 10^6	6.0
	d. Ferro Alloys Plant	Ton x 10^6	0.63
	e. Secondary Steel Melting Like Induction Furnace etc.	Ton x 10^6	0.5
	f. Rerolling Mills and Others and Reheating Furnace	Ton x 10^6	0.36
2.	Aluminium	Ton	410000
3.	Pulp and Paper	Ton	248500
4.	Sugar	Ton	
5.	Fertilizer	Ton	3099600
6.	Thermal Power	MW	5336

7.	Cement	Ton	3954000
8.	Fermentation Industries		
	a. Distilleries	KL	15720
	b. Breweries	KL	29000
	c. IMFL Bottling Plant	CASES	720000
9.	Chemical Industries		
	a. Chloro Alkali	Ton	24500
	b. Bulk Drugs	Ton	96
	c. Dye and Dye Intermediate	Ton	480
	d. Pesticides	Ton	600
10.	Mineral Processing and Crushers		
	a. Stone Crushers	Ton x 10^6	11.425
	b. Chrome Ore Benefication		
	c. Graphite Benefication		
	d. Coal Washeries	Ton	387500
	e. Iron Ore Crushers	Ton x 10^6	21.12
	f. Others like Mineral Sand Processing	Ton	
	g. Alumina Refinery	Ton	1575000
	h. Coke Ovens	Ton	240000
	i. Iron Ore Benefication	Ton	
11.	Food Processing and Allied Industries		
	a. Rice Mills	Ton	1875000
	b. Sea Food Processing	Ton	18600
	c. Beverages	Cases	
	d. Flour Mills	Ton	36000 x 12
	e. Dairy/Milk Chilling Centre	KL	140000

2.3 Sectorwise Industrial Scenario

The industrial topology varies widely, but most of them are mineral based and engaged in primary manufacturing activities. The state industrial scenario is dominated by iron and steel, power, cement, ferro alloy, sponge iron, pulp and paper and fertilizer industries. In small scale sector rice mills, stone crushers and brick kilns have a significant presence in the state. The following section presents a sectoral discussion.

2.3.1 Iron and Steel Industries

Iron and steel sector are undergoing rapid change in the state. Till 1995 there were only two Iron and Steel Plant in the state. Between 1995-2000 there was a marginal growth and period from 2000 onwards witnessed a rapid growth in iron and steel sector. The steel making route also witnessed a deviation from BF-BOF route to DRI-EAF/DRI-IF route. There are 14 steel plants in Orissa. Besides, four plants are now producing pig iron at Kalinga Nagar and at Barbil. The details of production capacity of these industries are compiled in ***Table 2.7*** and ***Table 2.8***.

TABLE: 2.7
Iron and Steel Plants in Orissa

Sl.	Name of Industry	Production Capacity (Million Ton / Annum)
1.	Rourkela Steel Plant	1.800
2.	Adhunik Metaliks	0.260
3.	OCL India Ltd. (Sponge Iron Division)	0.086
4.	Pawanjay Sponge Iron Ltd.	0.027
5.	Rexon Strips Ltd.	0.025
6.	Scan Steels Ltd.	0.002
7.	Shristi Ispat Ltd.	0.067
8.	Bhaskar Steel and Ferro Alloys Ltd.	0.072
9.	MSP Sponge Iron (P) Ltd.	0.018
10.	N. K. Bhojani (P) Ltd.	0.053
11.	Orissa Sponge Iron Ltd.	0.096
12.	Sree Metaliks (P) Ltd (Keonjhar)	0.130
13.	Sree Metaliks (P) Ltd (Angul)	0.051
14.	Bhusan Power and Steel Ltd.	0.108
	TOTAL	**2.795**

TABLE: 2.8
Pig Iron Plants in Orissa

Sl.	Name of the Industry	Production Capacity (Million Ton / Annum)
1.	Nilachal Ispat Nigam Ltd.	0.6
2.	MESCO Steel Ltd.	0.4
3.	VISA Steel Ltd.	0.175
4.	Kalinga Iron Works	0.15
	TOTAL	**1.325**

Out of 14 plants engaged in steel making only Rourkela Steel Plant is an integrated Steel Plant. Remaining 13 plants are making steel through DRI-IF/EAF route. These plants in addition to producing steel also produce sponge iron. These sponge iron plants are in different stage of expansion and their steel making capacity is likely to increase in near future. Besides, other sponge iron plants and pig iron units are also in different stages of expansion and modernization and likely to graduate to steel plants in future.

2.3.2 Sponge Iron

(a) Recent years have seen a technological shift in steel making. The current trend is to produce steel through DRI-EAF route. Because of availability of sponge grade iron ore and booming market, sponge iron has grown exponentially during last few years. There are 93 sponge iron plants already operating and some more are in the pipeline. Details of districtwise

operating sponge iron industries with production capacity and raw materials consumption are given in ***Table 2.9***.

The total installed capacity in sponge iron sector is about 20000 TPD. This sector alone consumes about 10 million ton of iron ore and about 9 million tons of coal annually. Though they are not water intensive Industries, they consume about 20 MLD of water.

TABLE: 2.9
Sponge Iron Industries Operating in Orissa

Sl.	District	Nos.	Capcity (TPD)	Iron Ore Cons. (TPD)	Coal Cons. (TPD)	Water (KLD)
1.	Sundargarh	46	6625	10600	9275	6625
2.	Keonjhar	19	5450	8720	7630	5450
3.	Jharsuguda	08	1750	2800	2450	1750
4.	Angul	03	600	960	840	600
5.	Jajpur	03	600	960	840	600
6.	Mayurbhanj	01	200	320	280	200
7.	Sambalpur	08	2300	3680	3220	2300
8.	Dhenkanal	02	800	1280	1120	800
9.	Cuttack	03	1250	2000	1750	1250
	TOTAL	**93**	**19575**	**31320**	**27405**	**19575**

Out of 93 sponge iron plants 13 plants have graduated to integrate steel plant by adding steel making facilities in the plants.

(b) The total pig iron production in the state is about 3.3 MT, of which Rourkela Steel Plant (RSP) produces about 2 MT per annum, which is used by RSP for steel production. Out of about 5.9 million tons of sponge iron produced per annum, about 1 million ton is used by various steel producing units. These sectors (pig iron, sponge iron and steel) use about 14.2 MT of iron ore.

Water consumption in the iron and steel/sponge iron sector is about 112 million liters per day (33.6 million cubic meter per annum).

2.3.3 Ferro Alloys

Ferro alloy is another sector which largely feeds on iron and chrome ore and steady power. Because of availability of iron ore and chromite ore in Orissa, ferro alloys plants have witnessed a sound growth in Orissa. There are 9 ferro alloys plants in the state in operation. The list of industries with production capacity and raw materials are given in ***Table 2.10***.

TABLE: 2.10
Ferro Alloys Plants in Orissa

Sl.	Name of Industry	Products	Production Capacity on HCFC Basis (TPA)
1.	FACOR, Randia, Bhadrak	Charge Chrome/ High Carbon Ferro Chrome	50,000
2.	Ferro Manganese Plant, TISCO, Joda, Keonjhar	High Carbon Ferro Manganese	30,000
3.	Ferro Alloys Plant, TISCO, Bamnipal	Charge Chrome/ Ferro Chrome	50,000
4.	ICCL, Choudwar	Charge Chrome/ Ferro Chrome	62,500
5.	IMFA (Plant I) Rayagada	Ferro Silicon/ Charge Chrome/High Carbon Ferro Chrome	100,000
6.	Balasore Alloys	Ferro Manganese, Ferro Silicon, Ferro Chrome and Silico Manganese	95,000
7.	Nav Bharat Ferro Chrome	High Carbon Ferro Chrome	50,000
8.	IDCOL Ferro Chrome and Alloys Ltd.	High Carbon Ferro Chrome	21,606
9.	Jindal Stainless Ltd. Kalinga Nagar *	High Carbon Ferro Chrome	1,80,000
		Total	**6,39,106**

* Jindal Stainless Ltd. will ultimately go for stainless steel manufacturing in near future.

These ferro alloy plants produce different alloys depending upon the market demand and accordingly their raw material consumption and production capacity also changes. In the table 2.10 the production capacity has been specified on the basis of HCFC (High Carbon Ferro Chrome)/ Charge Chrome. However specific raw material consumption per ton of product will provide an idea of raw material consumption in this sector (***Table 2.11***).

TABLE: 2.11
Raw Material Consumption per Ton of Ferro Alloys Production

Product Raw Material	SiMn	FeMn	FeCr
Manganese	1.65	2.55	--
OreCoke / Char Coal	0.75	0.65	0.75
FeMn Slag	0.70	--	--
Chrome Ore	--	--	2.5
Quartzite	0.25	--	0.15

2.3.4 Aluminium

There are two aluminium smelting industries in Orissa and one alumina plant (NALCO) is located in Damanjodi. The products, production technology adopted are compiled in ***Table 2.12***.

TABLE: 2.12
Aluminium Industries in Orissa

Sl.	Name of Industry	Products	Production Technology	Quantity in T/Annum	
				Existing	After Expansion
1.	NALCO, Angul	Aluminium	PBCW	345,000	460,000
2.	HINDALCO, Hirakud	Aluminium	HSS	65,000	100,000
TOTAL				**410,000**	**560,000**

PBWC-Pre Baked Centre Work HSS-Horizontal Stud Soderberg

This industry depends upon alumina and power. Orissa is a big repository of bauxite and coal, which is responsible for development of this sector. Consumptive pattern of major raw materials is presented in ***Table 2.13***.

TABLE: 2.13
Raw Material Consumptive Pattern of Aluminium Industries in Orissa

Sl.	Industry	Raw Material Consumption at Existing Capacity	
		Alumina (TPD)	Water (KLD)
1.	NALCO	1600	10,000
2.	INDAL	350	1250
	TOTAL	**1950**	**11,250**

2.3.5 Thermal Power Plant

Coal reserves in Ib Valley and Talcher area are the major factors for setting up of thermal power plants in the state. There are many captive power plants established with major industries to meet the industrial power requirements. The list of thermal power plants with power generation capacity and coal consumption is given in ***Table 2.14***. Captive power generation through DG & waste heat recovery boiler in sponge iron plant.

TABLE: 2.14
Thermal Power Plants in Orissa

Sl.	Thermal Power Plant	Generation Capacity (MW)	Coal Consumption (Ton/Day)
1.	NTPC, Kanhia	3000	36,000
2.	TTPS, Talcher	460	7,000
3.	NALCO, CPP, Angul	960	14,000
4.	ICCL, Choudwar	108	2,100
5.	Ib Thermal Power Station	420	6,500

6.	RSP – CPP, Rourkela	75	1,500
7.	NSPCL, CPP,	120	2,500
8.	Hirakud Power, Hirakud	167	2,000
9.	Nav Bharat Ferro Alloys, CPP	30	500
10.	OCFL – CPP, Paradeep	55	1,000
	TOTAL	**5395**	**73,100**

The state power sector consumes about 22 million tons of coal per annum for power generation.

2.3.6 Pulp and Paper Industries

There are six major pulp and paper industries in the state. The list of these industries with their production capacity and raw material consumption is given in ***Table 2.15***.

TABLE: 2.15
Paper Mills in Orissa

Sl.	Name of the Industry	Production Capacity (Ton/Day)	Raw Material Consumption		
			Wood, Bamboo	Straw	Waste Paper
1.	J.K. Paper Mill, Rayagada	300	800	--	--
2.	Emami Paper Mill, Balasore	100	1	40	130
3.	SPA Straw Board, Titlagarh	20			
4.	COSBOARD Industries, Jagatpur	30	--	--	65
5.	BILT (SEWA), Jeypore	240	650	--	--
6.	JB Agro Industries, Kalahandi	20	16		1.0 (Pulp)
	Total	**730**	**1467**	**40**	**196**

2.3.7 Sugar

There are 5 sugar mills in the state in operation. List of such units are given in ***Table 2.16***.

TABLE: 2.16
Sugar Mills in Orissa

Sl.	Name of the Industry	Crushing Capacity (TPD)	Sugar Production (TPM)
1.	Shakti Sugar Ltd., Dhenkanal	1500	4500
2.	Shakti Sugar Ltd. Badamba	1250	3375
3.	Aska Sugar Ltd., Aska	2500	2250
4.	Bargarh Co-Operative Sugar Ltd.	1250	3500
5.	Nayagarh Sugar Ltd.	1500	3750

The sugar cane cultivation in the state is not very popular and therefore the state is not producing enough cane to feed these sugar mills. Numbers of operating mills in fact declined during last decade.

2.3.8 Fertilizer

There are two major phosphatic fertilizer plants operating in the state. Some fertilizer plants like FCI, Talcher, East Coast Fertilizer, Kalma and SAIL, Rourkela are closed. The list of fertilizer industries with production capacity and raw materials are given in ***Table 2.17***.

TABLE: 2.17
Fertilizer Plants in Orissa

Sl.	Name of Industry	Products	Production Capacity (TPD)	Raw Material Consumption in MT/Day		
				Sulphur	Rock Phosphate	Ammonia
1.	IFFCO Ltd.	DAP	6400	2400	10000	1800
2.	Paradeep Phosphate Ltd.	DAP	2400	800	2700	810
		TOTAL	**8800**	**3200**	**12700**	**2610**

Sulphuric acid plant of IFFCO Ltd. is the largest such industry in Asia. Both of these plants are located in Paradeep since they fully depend upon the imported raw materials.

2.3.9 Cement

There are ten major cement plants in Orissa. Out of this four have rotary kilns and three have vertical shaft kiln. Besides these, there are three cement grinding units operating in the state. At one point of time, there were 28 cement plants, the number has currently come down to 10. Most of them are vertical shaft kilns. The statement giving the status of cement plant in the state are presented below in ***Table 2.18***.

Table 2.18
Cement Plants in Orissa

Sl.	Name and Address of Industry	Capacity in Metric Tonnes Per Day	Process Technology	Air Pollution Control Equipment Installed
1.	OCL India Ltd. PO: Rajgangpur Dist.: Sundargrah	4850	Rotary Kiln	Electrostatic Precipitator for Cement Mill and Kiln Bag Filter for other sections
2.	IDCOL Cement Ltd. PO: Bardol Dist.: Bargarh	2630	Rotary Kiln	Electrostatic Precipitator at Ball Mill and Kiln, Cooler End Pulse Jet Bag Filter for other sections Cyclone for Coal Mill
3.	Shiva Cement Ltd. (Unit – II) (IPISP) Sumangalnagar PO: Kutra Dist.: Sundargarh	350	Rotary Kiln	Pulse Jet Bag Filter at Rotary Kiln, Raw Mill, Cement Mill, Raw Mill Silo, Cement Silo, Coal Mill

4.	Chariot Cement Company (Unit – I) Kalunga Ind. Estate Dist.: Sundagarh	200	Vertical Shaft Kiln	Pulse Jet Bag Filter for Cement Mill (I & II) Venturi Scrubber for VSK (I & II) Rotary Slag Drier and Reverse Jet Bag Filter
5.	Susila Cement Ltd. Rajgangpur Rourkela	50	Vertical Shaft Kiln	Venturi Scrubber at VSK Filter Bags at other sections like hammer mill, bending silos, cement mill hoppers etc.
6.	Sita Cement Ltd. Telingana Dist – Sundargarh	100	Vertical Shaft Kiln	Bag Filter at Jaw Crusher Ventury Scrubber at VSK (I & II) Filter Cloth at Noduliser
7.	L & T Cement Ltd. PO.: Arda Jharsuguda Sundargarh	2000	Cement Grinding	Electrostatic Precipitator for cement grinding section Pulse ject bag filter for other sections
8.	Chariot Cement Company (Unit – I) Kalunga Ind. Estate Dist.: Sundargarh	200	Cement Grinding	Pulse Jet Bag Filter for cement mill and cement silo
9.	KGN Cement Mandiakudar Dist.: Sundargarh	50	Cement Grinding Unit	Filter bags at clinker grinding section and other sections
10.	Toshali Cements Koraput	600	Rotary Kiln	ESP

2.3.10 Rice Mills

Rice mills have a significant presence in small scale sector and located mostly in the irrigated areas where paddy production is predominant. In fact, large number of rice mills have been set up in Hirakud command area. About 218 rice mills are operating in the state. Region wise distribution of rice mills are given in ***Table 2.19***.

TABLE: 2.19
Region Wise Distribution of Rice Mills in Orissa

Sl. No.	Region (Districts)	No. of Rice Mills
1.	Balasore (Balasore, Bhadrak, Mayurbhanj)	12
2.	Berhampur (Ganjam, Nayagarh, Gajapati)	03
3.	Cuttack (Cuttack, Jajpur, Jagatsinghpur, Kendrapara)	03
4.	Bhubaneswar, Khurda, Puri)	01
5.	Rayagada (Rayagada, Koraput, Malkangiri, Kalahandi)	54
6.	Sambalpur (Sambalpur, Balangir, Bargarh, Nuapada, Sonepur, Boudh)	145
	TOTAL	**218**

It may be seen that Sambalpur and Bargarh districts of Sambalpur region has maximum 145 rice mills followed by Kalahandi and Nuapada districts in Rayagada region.

2.3.11 Stone Crushers

Stone crushers constitute the largest number of industrial units in small scale sector. 914 stone crushers have been identified. The crushing capacities of these units vary from 10 ton/hour to 200 ton/hour. Stone crushers operating in different districts of Orissa are compiled and presented in ***Table 2.20***.

TABLE: 2.20
District Wise Stone Crushers in Orissa

Sl	Name of the district	Total nos. of stone crushing units
1.	Angul	45
2.	Balasore	37
3.	Bargarh	24
4.	Bhadrak	03
5.	Bolangir	32
6.	Boudh	05
7.	Cuttack	13
8.	Deogarh	12
9.	Dhenkanal	90
10.	Gajapati	02
11.	Ganjam	42
12.	Jajpur	225
13.	Jharsuguda	12
14.	Kalahandi	23
15.	Kandhamal	01
16.	Kendrapara	01
17.	Kendujhar	21
18.	Khurda	156
19.	Koraput	11
20.	Malkangiri	02
21.	Mayurbhanj	41
22.	Nawarangpur	04
23.	Nayagarh	06
24.	Nuapada	18
25.	Rayagada	10
26.	Sambalpur	51
27.	Sonepur	02
28.	Sundargarh	35
	Total	**924**

All these stone crushers annually crush about 10 million tons of boulders. Jajpur and Khurda districts have the largest number of stone crushers operating. There are two major clusters of the stone crushers like;

- Chandikhole – Jaraka
- Khurda – Tapanga.

2.3.12 Brick Kilns

Large number of brick kilns are operating in the state. Since brick is one of the essential building materials, kilns are dispersed throughout the state. In view of a prohibitory order of Ministry of Environment and Forests the moving chimney brick kilns are being replaced with fixed chimney kilns. District wise distribution of brick kilns operating in the state is presented in ***Table 2.21***. About half of the total brick kilns in Bhubaneswar, to meet its demand.

TABLE: 2.21
District Wise Brick Kilns in Orissa

Sl.	Name of the District	Numbers
1.	Balasore	52
2.	Mayurbhanj	24
3.	Khurda	33
4.	Cuttack (Undivided)	78
5.	Sundargarh	18
6.	Sambalpur	08
7.	Jharsuguda	05
8.	Bargarh	06
9.	Dhenkanal	04
10.	Kendujhar	01
11.	Bhadrak	02
	Total	**231**

2.4 Impact

2.4.1 Water Pollution

2.4.1.1 Sources and Treatment

The major sources of water pollution is discharge of industrial wastewater, sewage discharge from urban bodies, disposal of industrial and urban solid wastes. This section discusses the potential of industrial sector in water pollution. Sector wise industry specific water polluting parameters in ***Table 2.22*** gives an idea on the type of stress that is imparted on the water quality of water bodies.

TABLE: 2.22
Industry Specific Water Pollution

Sl.	Industrial Sector	Water Pollution Parameters
1.	Pulp and Paper	Colour, BOD, COD, Sodium Absorption Values, S.S.
2.	Iron and Steel	pH, Phenol, Cyanide, Heavy Metals, BOD, COD, S.S., Oil and Grease
3.	Fertilizer (Phosphatic)	pH, Phosphate, Fluoride
4.	Aluminium	Fluoride, Oil and Grease

5.	Rice Mills	BOD, S.S., COD
6.	Distillery	BOD, COD, S.S.
7.	Sugar	BOD, COD, S.S
8.	Chemicals	Heavy Metals, Organic Complex
9.	Sea Food Processing	BOD, COD

BOD-Biochemical Oxygen Demand, COD-Chemical Oxygen Demand, SS-Suspended Solids

Most of the water polluting industries have effluent treatment plants in place. A generalized Sector wise effluent treatment system adopted by different industrial sectors in the state are compiled in ***Table 2.23***.

TABLE: 2.23
Industry Specific Effluent Treatment

Sl.	Industrial Sector	Type of Effluent Treatment
1.	Pulp and Paper	Activated Sludge Treatment Plant
2.	Iron and Steel	Unitwise ETP – Coal Chemical – BOD Plant, Rolling Mills – Chemical Treatment Catch Pits
3.	Fertilizer (Phosphatic)	Chemical Treatment Plant for Fluoride and Phosphatic removal
4.	Aluminium	Ion Exchange, Oil and Grease Trap
5.	Rice Mills	Settling Tanks, Sand Filtration
6.	Distillery	Anaerobic, Aerobic Biological Treatment, Biomethynation
7.	Sugar	Activated Sludge Treatment
8.	Chemicals	Chemical Treatment
9.	Sea Food Processing	Biological Treatment

The State Pollution Control Board monitors the water quality of all the major rivers in the state under National Water Quality Monitoring Programme of Government of India. Analysis of the monitoring results indicates that major water polluting industries are located on the banks of four rivers, they are, Brahmani, Mahanadi, Rushikulya, and Nagavali. The water analysis of river stretches is presented in tables with respect to BOD which is the critical parameter.

2.4.1.2 River Brahmani

Industrial wastewater intervene river Brahmani primarily at two regions, that is in Rourkela and Talcher. In Rourkela the wastewater goes to Brahmani, from for the Rourkela Steel Plant. Similarly in Talcher region the industrial wastewater is carried through the Tikira river and Nandira river to Brahmani. The pollution load due to the industries in river stretches is presented in ***Table 2.24***.

TABLE: 2.24
Pollution Load Due to Industries on Major Rivers

Sl.	Name of Industry	Effluent Quantity in KLD	BOD (Kg/D)	COD (Kg/D)	O & G (Kg/D)	Others
A.	**Rourkela Region (River Brahmani)**					
1.	Rourkela Steel Plant	52,800	950	4000	582	--
2.	IDL Chemicals	40	--	10	--	NO_3 1.2 kg/d
Total Industrial Load from Rourkela		52,840	950	4,010	582	
B.	**Talcher – Angul Area (River Brahmani)**					
1.	NTPC, Kahnia	6,500	200	1375	65	
2.	NALCO	25,000	150	--	50	
3.	TTPS, Talcher	3,000	90	--	30	
4.	MCL (Talcher)	19,500	--	--	--	
Total Industrial Load from Talcher		54,000	440	1,375	145	

TABLE: 2.25
BOD along the Stretches of River Brahmani (Rourkela)

Sl. No.	Sampling Station	Approx. Km. from D/S	BOD (mg/l)
1.	Panposh U/S		1.0
2.	Panposh D/S (Deogaon Village)	200 m from Discharge Point of RSP	3.7
3.	Panposh D/S (1/2 Km. away from D/S Deogaon Village)	1 Km. from D/S	3.2
4.	Panposh FD/S (Jalda Village)	4 km D/S	2.7

2.4.1.3 River Mahanadi

The industrial activity along river Mahanadi is not as intense as along Brahmani. The industrial wastewater intervenes this river primarily at three places, one at Hirakud and the other near Cuttack and the last one near the mounth of Paradeep. The pollution load presented in the table 2.26 indicates that they are much less in comparison to Brahmani river. The pollution load is presented in ***Table 2.26***.

TABLE 2.26
Pollution Load Due to Industries on Major Rivers

Sl.	Name of Industry	Effluent Quantity in KLD	BOD (Kg/D)	COD (Kg/D)	O & G (Kg/D)	Others
A.	**River Mahanadi**					
1.	INDAL, Hirakud	736	22	--	--	--
Total Industrial Load from Hirakud		**736**	**22**	**--**	**--**	**--**
B.	**River Mahanadi (Cuttack)**					
1.	Central Orissa Straw Board	1000	30	220	--	--

3.	ICCL (CPP & FAP)	1780	--	30	--	--
Total Industrial Load from Cuttack		**2780**	**30**	**250**	**--**	**--**
C.	**River Mahanadi (Paradeep)**					
1.	Paradeep Phosphate Ltd.	4320	--	--	7.5	--
2.	IFFCO (Dom)	960	15	35	--	--
Total Industrial Load from Paradeep		**5280**	**15**	**35**	**7.5**	**--**

TABLE: 2.27

BOD along the Stretches of River Mahanadi

Sl. No.	Sampling Station	Approx. Km. from D/S	BOD (mg/l)
1.	Sambalpur U/S		1.2
2.	Sambalpur D/S	500 m from sewage discharge point	3.52
3.	Sambalpur D/S (Shankar Math, Dhanupali)	2.5 Km from D/S	2.3
4.	Sambalpur FD/S (At Khandwal)	4 Km form D/S	1.98
5.	Mahanadi U/S (Mundulli Barrage)		1.3
6.	Mahanadi D/S (Bidyadharpur)	500 m from discharge point	3.0
7.	Mahanadi FD/S (Gatiroutpatna)	2 Km from D/S	1.65
8.	Kuakhai U/S		1.0
9.	Kuakhai D/S (Kanti Bridge)	500 m from the confluence point with Gangua river	3.2
10.	Kuakhai FD/S (Manitripada)	2 Km from D/S	1.65
11.	Mahanadi U/S (Munduli Barrage)		1.3
12.	Kathajodi D/S (Urali Block)	500 m from Khan Nagar	3.97
13.	Kathajodi FD/S (Bali Sahi)	2 Km from D/S	3.0
14.	Sankhataras	5-6 Km from D/S	2.31

2.4.1.4 Other Rivers

The industrial intervention in other rivers like Rushikulya and Nagavali are also found to be significant. This is because of leanflow in the river and potential risk of toxic chemical presence in the industrial effluent.

Wastewater from industries is discharged mainly to different surface water streams. In all the stretches of rivers where the water quality is close to the Designated Best Use quality limits, BOD has been found to be the only critical parameter. This indicates that contamination of river water due to chemicals are rather insignificant. Significant presence of BOD indicates that the major interventions are of anthropogenic in nature. The pollution load due to only industries (excluding mines) are presented in ***Table 2.28***.

TABLE: 2.28
Pollution Load Due to Industries on Major Rivers

Sl.	Name of Industry	Effluent Quantity in KLD	BOD (Kg/D)	COD (Kg/D)	O & G (Kg/D)
A.	**River Rushikulya**				
1.	Jayashree Chemicals	80	--	--	--
Total Industrial Load from Chhatrapur		80	--	--	--
B.	**River Nagavali**				
1.	JK Paper Mill	35,000	1000	8750	--
Total Industrial Load from Rayagada		35,000	1000	8750	--

2.4.1.5 Water Quality

The water quality of rivers are regularly monitored by State Pollution Control Board in 39 monitoring stations.

The water quality (in terms of annual average BOD) of Mahanadi and Brahmani are presented in ***Table 2.29***.

TABLE: 2.29
BOD in River Water

A. River Brahmani

Year	Panposh U/S	Panposh D/S	Rourkela D/S	Bonaigarh	Rengali	Samal
	1	2	3	4	5	6
1999	2.9	5.4	4.0	2.8	2.9	3.0
2000	2.9	4.3	3.21	2.9	2.65	2.75
2001	2.2	3.6	2.9	2.5	2.2	2.3
2002	2.3	4.8	3.3	2.3	2.0	1.9
2003	1.38	3.55	2.31	1.12	1.56	1.76
2004	1.2	4.0	3.0	1.4	1.2	1.1
2005	1.0	3.8	2.7	1.0	1.2	1.2

Year	Kamalanga U/S	Kamalanga D/S	Bhuban	Dharmasala	Pottamundai
	7	8	9	10	11
1999	3.5	4.6	3.6	3.7	3.0
2000	2.7	4.2	3.5	3.5	3.3
2001	2.5	4.2	2.4	2.3	2.5
2002	2.2	3.7	2.7	2.6	2.3
2003	1.38	2.46	2.03	1.47	1.44
2004	1.3	2.6	1.6	1.6	1.4
2005	1.5	1.5	1.2	0.9	1.2

Figure - 2.2
Trend of BOD in Panposh D/S

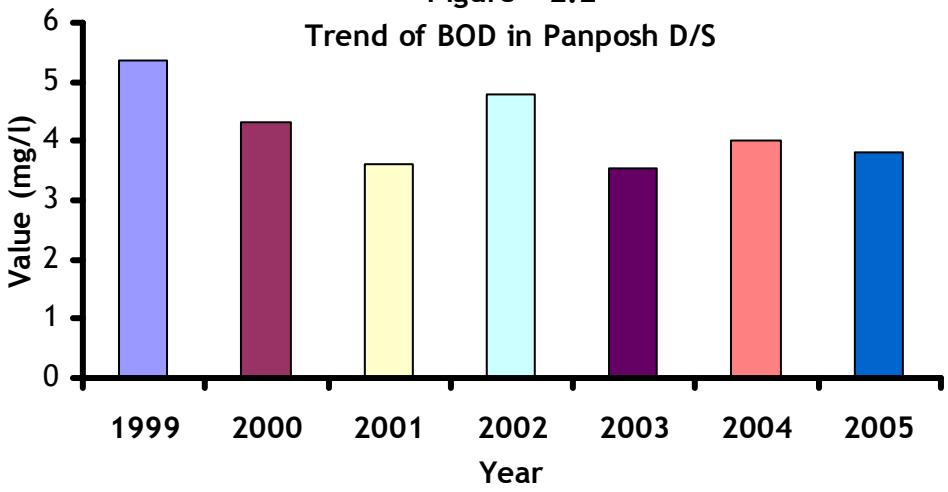
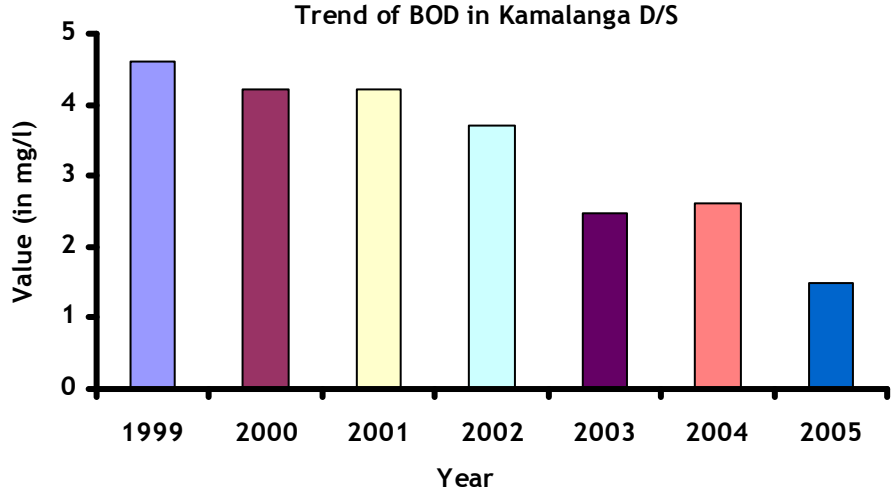


Figure - 2.3
Trend of BOD in Kamalanga D/S

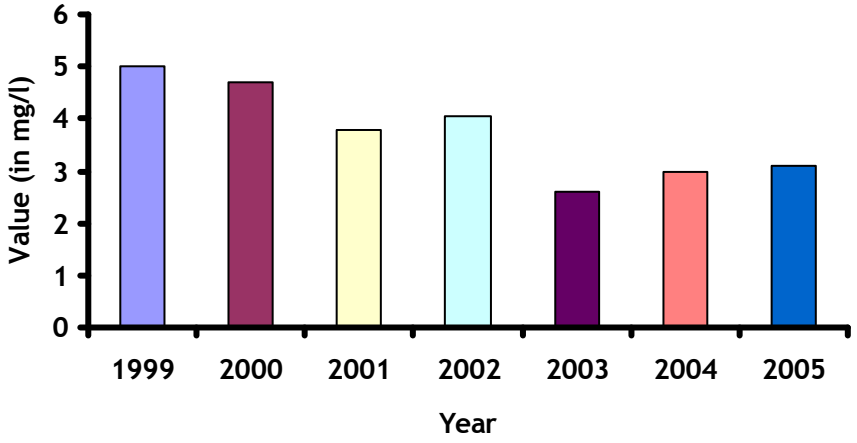


B. River Mahanadi

Year	Sundargarh	Jharsuguda	Hirakud	Brajraj Nagar U/S	Brajraj Nagar D/S	SBP U/S	SBP D/S	Sonepur U/S	Sonepur D/S
	1	2	3	4	5	6	7	8	9
1999	2.8	3.8	2.7	3.3	4.5	3.6	5.0	2.9	3.7
2000	2.9	3.5	2.6	3.0	4.3	3.0	4.7	2.5	3.6
2001	2.1	2.3	2.1	2.1	2.7	2.69	3.8	2.0	3.2
2002	2.11	2.35	1.95	2.32	2.92	2.39	4.04	1.75	3.0
2003	1.5	1.6	0.98	1.3	1.9	1.4	2.6	1.4	2.4
2004	1.0	1.0	0.9	1.2	1.9	1.4	3.0	0.8	1.4
2005	1.1	1.1	0.7	1.1	1.6	1.1	3.1	1.3	1.8

Year	Tikarpada	Narsingpur	CTC U/S	CTC D/S	Kathjori D/S	Kuakhai U/S	Kuakhai D/S	Birupa D/S	Paradeep D/S
	10	11	12	13	14	15	16	17	18
1999	2.8	2.7	3.4	5.3	5.5	3.4	5.6	--	--
2000	3.0	2.5	2.6	4.2	4.6	3.4	5.0	--	--
2001	2.0	2.3	2.2	3.4	5.4	2.3	3.9		
2002	2.48	1.77	2.36	3.59	4.25	2.59	3.91	2.13	4.95
2003	1.2	1.4	1.5	2.7	2.8	1.5	3.0	1.7	3.1
2004	1.0	1.3	1.3	2.3	3.6	1.2	3.1	1.4	2.4
2005	0.9	1.0	1.5	2.8	4.2	1.3	2.8	1.5	2.0

Figure - 2.4
Trend of BOD in Sambalpur D/S



2.4.2 Air Pollution

2.4.2.1 Sources and Type of Air Pollutants

Air pollution is caused due to emission from industries and associated activities. The level of air pollution depends on the quantity and type of emission. Further the effect of air pollutants on environment depend on level of dispersion which is guided by meteorological conditions. Air pollutants also depend on the type of industrial activities and may be from stationary sources like stacks and from fugitive emissions. Major industrial sectors of Orissa and relevant air pollutants are compiled in ***Table 2.30***.

TABLE: 2.30
Industry Specific Air Pollutants

Sl.	Sector	Air Pollutants
1.	Iron and Steel	SPM, Hydrocarbon, SO_2, NO_X, Carbon Monoxide
2.	Sponge Iron	Particulate Matter (PM)
3.	Thermal Power Plants	PM, SO_2, NO_X
4.	Cement	PM
5.	Fertilizer (Phosphatic)	PM, SO_2, Acid Mist, Fluoride

6.	Aluminium	Fluoride, PM
7.	Refractory	PM
8.	Rice Mills	PM
9.	Chemical	Acidic Fume, Complex Chemicals
10.	Ferro Alloys	PM, SO_2, NOX
11.	Pulp and Paper	PM, SO_2, Mercaptan
12.	Sugar	PM
13.	Stone Crusher	PM
14.	Brick Kiln	PM, SO_2
SPM – Suspended Particulate Matter, PM – Particulate Matter, SO_2 – Sulphur Dioxide, NO_X – Oxides of Nitrogen		

Most of the industries have various air pollution control equipments. Major air pollution control equipments provided in air polluting industrial sectors in Orissa are presented in ***Table 2.31***.

TABLE: 2.31
Air Pollution Control Equipments in Major Industrial Sectors of Orissa

Sl.	Industry	Air Pollution Control Equipment
1.	Iron and Steel	ESP, Bag Filter, Scrubber
2.	Sponge Iron	ESP, Bag Filter
3.	Cement	ESP, Bag Filter, Cyclone
4.	Fertilizer	Scrubber, Acid Mist Eliminator
5.	Thermal Power Plant	ESP, Cyclone, Water Spraying
6.	Aluminium	Dry Scrubber
7.	Refractory	Pulse Jet Type Bag Filter
8.	Rice Mills	Cyclone, Dust Chamber
9.	Ferro Alloys	Gas Cleaning Plant, Bag Filter
10.	Pulp and Paper	ESP, Cyclone, Bag Filter
11.	Sugar	Cyclone
12.	Stone Crusher	Water Spraying
13.	Brick Kiln	Fixed Chimney
14.	Chemicals	Scrubber

ESP-Electro Static Precipitator

The pollution loads due to major industries in the 12 industrial areas are presented in ***Table 2.32***.

TABLE: 2.32
Areawise Air Emission Scenario
Rourkela – Rajgangpur Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Integrated Steel Plant	1	15.0	14.0
Sponge Iron Plants	31	7.8	--
Cement Plants	1	1.8	--
Thermal Power Plant	2	9.4	31.0
Total	**35**	**34.0**	**45.0**

TSP-Total Suspended Particulates **SO_2-Sulphur Dioxide**

Ib Valley Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Thermal Power Plant	1	8.4	4.7
Refractories	1	0.1	--
Sponge Iron Plants	8	2.3	--
Total	**10**	**10.8**	**4.7**

Talcher – Angul Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)	F (TPD)
Thermal Power Plant	4	80.0	350.0	--
Aluminium	1	3.0	--	1.0
Sponge Iron	3	0.9	--	--
Ferro Alloy	1	0.2	--	--
Total	**9**	**84.1**	**350.0**	**1.0**

F-Fluoride

Sambalpur Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)	F (TPD)
Aluminium	1	0.80	--	0.5
Thermal Power Plant	1	2.0	11.2	--
Total	**2**	**2.80**	**11.2**	**0.5**

F-Fluoride

Duburi Industrial and Adjacent Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Iron & Steel	1	8.0	7.5
Ferro Alloy	2	0.25	--
Sponge Iron	2	0.6	--
Total	**5**	**8.85**	**7.5**

Paradeep Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Fertilizer	2	0.9	22.0
Carbon	1	0.1	--
Total	**3**	**1.0**	**22.0**

Joda Barbil Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Pig Iron & Sponge Iron Plants	13	4.750	--
Ferro Alloy Plant	1	0.1	
Iron Ore Crusher	63	4.0	--
Total	**77**	**8.85**	**--**

Chandikhol - Dharmasala Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Stone Crusher	225	2.2	--
Total	**225**	**2.2**	**--**

Choudwar Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Ferro Alloy	1	0.25	--
Thermal Power	1	2.0	17.0
Total	**2**	**2.25**	**17.0**

Khurda – Tapang Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Stone Crusher	155	1.5	--
Total	**155**	**1.5**	**--**

Rayagada Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Pulp and Paper	1	0.75	--
Ferro Alloy	1	0.25	--
Total	**2**	**1.0**	**--**

Balasore Area

Type of Industries	Nos.	TSP (TPD)	SO_2 (TPD)
Ferro Alloys	2	0.35	--
Pulp and Paper	1	0.35	--
Rubber	1	0.30	--
Total	**4**	**1.0**	**--**

2.4.2.2 TSP – Total Suspended Particulate

The above tables summerise the pollution load due to industrial activities in major industrial areas in the state. Besides this, the transport and mining sectors also contribute significantly to the overall air pollution load. The ambient air quality depends upon the local meteorological condition, magnitude of pollution load, height of pollutant emission and pollution from other sources.

More than the air pollution load, the ambient air quality of an area is of prime importance, since this determines the exposure level to the human beings and its effect on human health. In accordance with the National Ambient Air Quality monitoring guidelines SPM, SO_2, and NO_X are monitored by the State Pollution Control Board. The Total Suspended Particulate of major industrial areas are presented in ***Table – 2.33***.

TABLE: 2.33
Total Suspended Particulate of Major Industrial Areas

SL.	Area	TSP (TPD)
01.	Rourkela – Rajgangpur	34.0
02.	Ib Valley	10.8
03.	Talcher – Angul	84.1

04.	Sambalpur	2.80
05.	Duburi Industrial and Adjacent	8.85
06.	Paradeep	1.0
07.	Joda Barbil	8.85
08.	Chandikhol - Dharmasala	2.2
09.	Choudwar	2.25
10.	Khurda – Tapang	1.5
11.	Rayagada	1.0
12.	Balasore	1.0

Figure - 2.5
Total Suspended Particulate of Major Industrial Areas

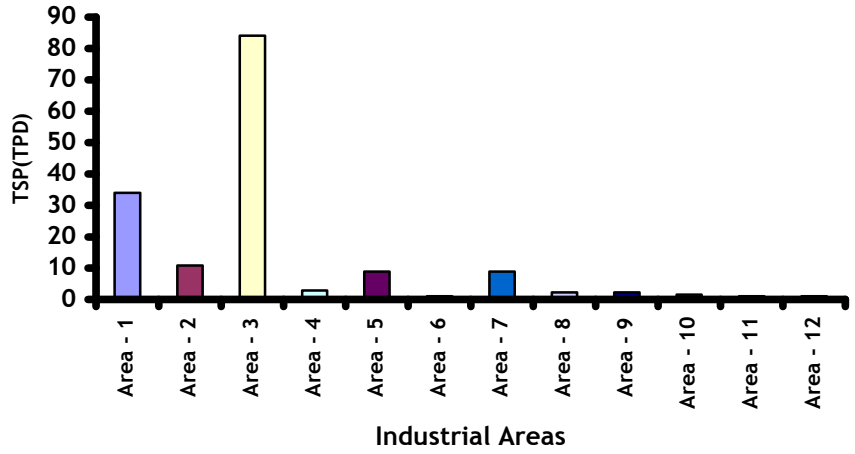


TABLE: 2.34
Annual Average Ambient Air Quality at Uditnagar Rourkela (Residential) During 1998- 2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
1998	187	32.0	32
1999	238	20.0	17.0
2000	200	18.0	23.0
2001	201	9.0	19.0
2002	184	8.0	15.0
2003	148	5.0	10.0
2004	161	5.0	10.0
2005	167	11.0	11.0
Standard ($\mu g\ m^3$)	**140**	**60**	**60**

SPM-Suspended Particulate Matter, SO_2-Sulphur Dioxide, NO_X-Oxide of Nitrogen

Figure - 2.6
Trend of SPM, SO_2 and NOx at Udit Nagar, Rourkela

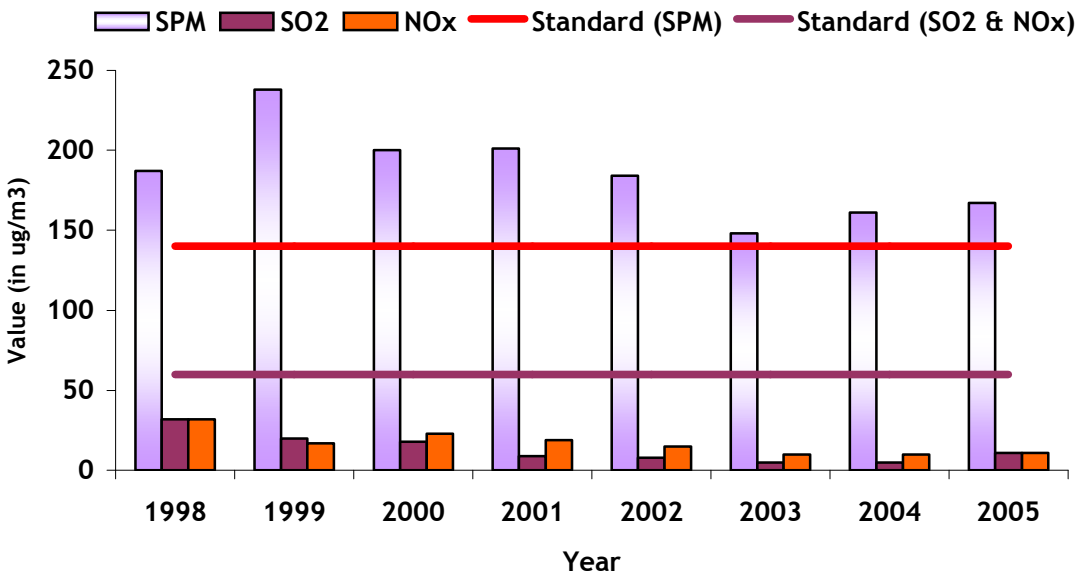


TABLE: 2.35
Annual Average Ambient Air Quality at IDL Complex
(Residential) During 1998-2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
1998	147	33.0	26.0
1999	175	19.0	19.0
2000	221	15.0	15.0
2001	189	10.0	12.0
2002	159	7.0	11.0
2003	174	5.0	9.0
2004	182	4.4	9.0
2005	162	5.0	10.0
Standard ($\mu g\ m^3$)	**140**	**60**	**60**

TABLE: 2.36
Annual Avearage Ambient Air Quality at Angul
(Industrial) During 1998-2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
1998	148	10.0	9.0
1999	97	9.0	6.0
2000	222	6.0	30.0
2001	190	11.0	26.0
2002	198	18.0	17.0
2003	162	6.0	12.0
2004	181	6.0	8.0
2005	214	6.0	12.0
Standard ($\mu g\ m^3$)	**360**	**80**	**80**

Figure - 2.7
Trend of SPM, SO_2 and NOx at Angul (Industrial)

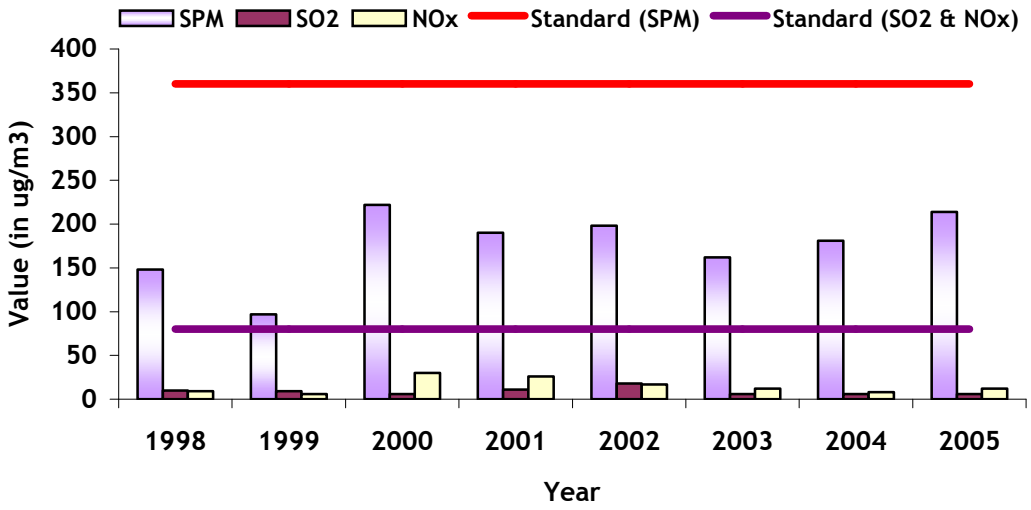


TABLE: 2.37
Annual Average Ambient Air Quality at NALCO (Residential) During 1998-2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
1998	108	7.0	10.0
1999	119	BDL	BDL
2000	129	6.0	22.0
2001	130	6.0	24.0
2002	127	15.0	15.0
2003	112	4.0	16.0
2004	112	BDL	16.0
2005	116	5.0	20.0
Standard ($\mu g\ m^3$)	**140**	**60**	**60**

BDL-Below Detectable Limit

TABLE: 2.38
Annual Average Ambient Air Quality at TTPS (Industrial) During 1998-2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
1998	177	10.0	10.0
1999	169	6.0	11.0
2000	194	5.0	21.0
2001	187	7.0	31.0
2002	195	10.0	27.0
2003	153	6.0	22.0
2004	159	5.0	19.0
2005	140	6.0	19.0
Standard ($\mu g\ m^3$)	**360**	**80**	**80**

Figure - 2.8
Trend of SPM, SO2 and NOX at TTPS, Talcher

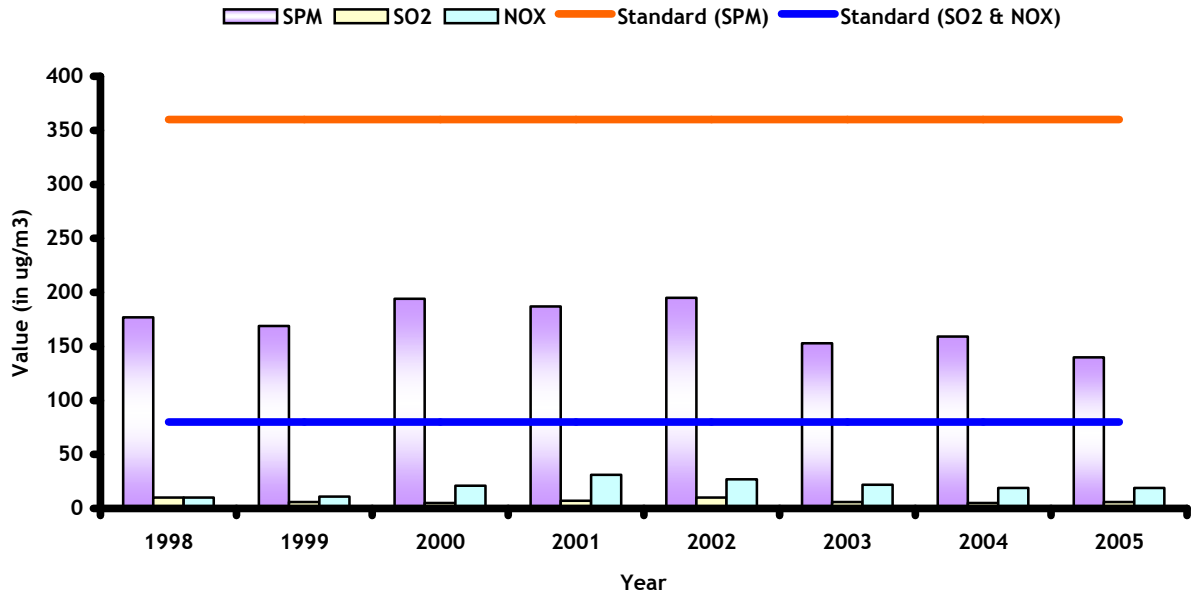


TABLE: 2.39
Annual Avearage Ambient Air Quality at RO Office Rayagada (Residential) During 1998-2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
1998	122	8.0	16.0
1999	118	8.0	15.0
2000	128	9.0	15.0
2001	129	8.0	14.0
2002	113	7.0	22.0
2003	91	BDL	BDL
2004	100	BDL	BDL
2005	137	BDL	11.0
Standard ($\mu g\ m^3$)	**140**	**60**	**60**

TABLE: 2.40
Annual Average Ambient Air Quality at Jaykaypur (Industrial) During 1998-2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
1998	152	15.0	22.0
1999	139	12.0	17.0
2000	157	14.0	24.0
2001	152	12.0	19.0
2002	141	11.0	19.0
2003	119	6.0	10.0
2004	135	BDL	10.0
2005	167	BDL	14.0
Standard ($\mu g\ m^3$)	**360**	**80**	**80**

Figure - 2.9
Trend of SPM, SO_2 and NOx at Jaykaypur (Industrial)

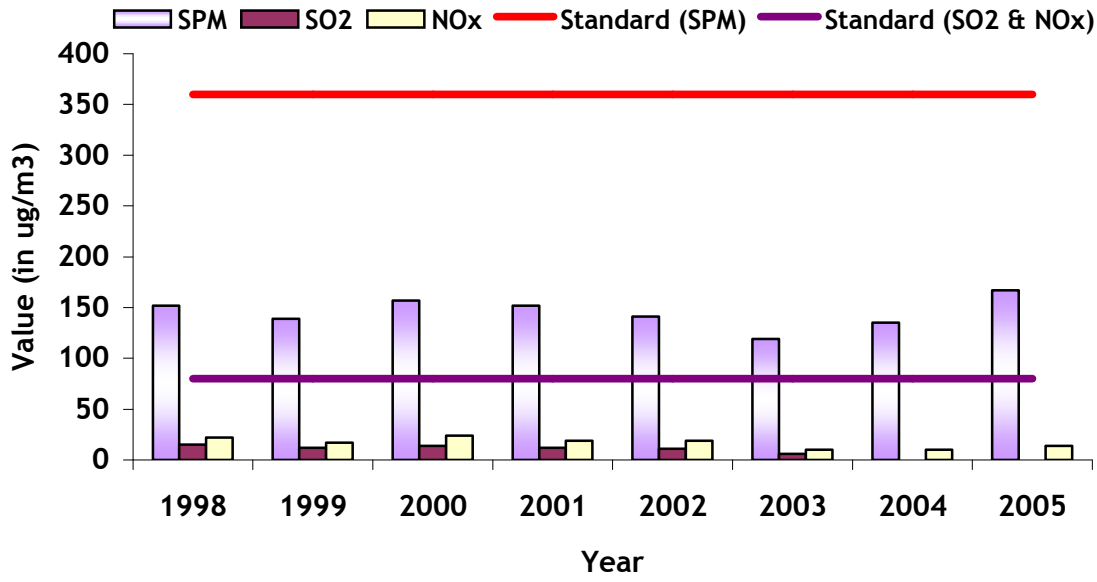


TABLE: 2.41
Annual Avearage Ambient Air Quality at Balasore (Residential) During 2003 -2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
2003	148.0	7.0	15.0
2004	91	4.0	15.0
2005	124	BDL	10.0
Standard ($\mu g\ m^3$)	**140**	**60**	**60**

TABLE: 2.42
Annual Avearage Ambient Air Quality at Berhampur (Residential) During 2004 -2005

Year	SPM ($\mu g\ m^{-3}$)	SO_2 ($\mu g\ m^{-3}$)	NO_X ($\mu g\ m^{-3}$)
2004	146.0	Not monitored	Not Monitored
2005	148.0	Not Monitored	Not Monitored
Standard ($\mu g\ m^3$)	**140**	**60**	**60**

Ambient air quality standard prescribed by Ministry of Environment and Forests, Government of India is given in ***Table 2.45***.

2.4.2.3 Air Quality Assessment

Air quality in terms of low, moderate, high and critical, in cities/towns monitored during the period is presented below in ***Table-2.44***. The concentration ranges for different levels have been selected based on the notified standards (S) for different pollutants and area classes. The standard governing for defining the designated class is given in ***Table – 2.43***.

TABLE: 2.43
Ambient Air Quality Criteria

Annual Mean Conc. Range (μg m^{-3})						
	Industrial (I)	SO_2 & NO_X	SPM	Residential (R)	SO_2 & NO_X	SPM
Low	L	0-40	0-180	L	0-30	0-70
Moderate	M	40-80	180-360	M	30-60	70-140
High	H	80-120	360-540	H	60-90	140-210
Critical	C	>120	>540	C	>90	>210

TABLE: 2.44
Air Quality Statistics in Major Industrial Area/Cities in Orissa

Station Name	2002			2003			2004			2005		
	SPM	SO_2	NO_X	SPM	SO_2	NO_X	SPM	SO_2	NO_X	SPM	SO_2	NO_X
Angul (I)	M	L	L	L	L	L	M	L	L	M	L	L
NALCO (R)	H	L	L	M	L	L	M	L	L	M	L	L
TTPS (I)	M	L	L	L	L	L	L	L	L	L	L	L
IDL, Rourkela (R)	H	L	L	H	L	L	H	L	L	H	L	L
Udit Nagar, Rourkela (R)	H	L	L	H	L	L	H	L	L	H	L	L
Regional Office, Rayagada (R)	M	L	L	M	L	L	M	L	L	M	L	L
Jaykaypur (I)	L	L	L	L	L	L	L	L	L	L	L	L
Balasore (R)	--	--	--	H	L	L	M	L	L	M	L	L

TABLE: 2.45
Ambient Air Quality Standard

Pollutants	Time Weighted Average	Concentration in Ambient Air			Method of Measurement
		Industrial Area	Sensitive Area***	Residential, Rural & Other Area	
Sulphur Dioxide SO_2 (μg/m^3)	Annual *	80	15	60	Impraed West & Gacke Method Ultraviolet Fluorescence
	24 Hours**	120	30	80	
Oxides of Nitrogen as NO_2 (μg/m^3)	Annual *	80	15	60	Jacob & Hochhwser modified Gas Phase Chemiluminiscence
	24 Hours**	120	30	80	

Suspended Particulate Matter (SPM) ($\mu g/m^3$)	Annual *	360	70	140	High Volume Sampling (Average Flow rate not less than1.1m^3/minute
	24 Hours**	500	100	200	
Respirable Particulate Matter (Size Less than 10μg) (RPM) ($\mu g/m^3$)	Annual *	120	50	60	Respirable Particulate Matter Sampler
	24 Hours**	150	75	100	
Lead (Pb) ($\mu g/m^3$)	Annual *	1.0	0.50	0.75	AAS Method after sampling using EPM 20000 equivalent paper
	24 Hours**	1.5	0.75	1.0	
Carbon Monoxide (CO) ($\mu g/m^3$)	8 hours**	5.0	1.0	2.0	Non Dispersive Infrared Spectroscopy
	1 Hours	10.0	2.0	4.0	

* Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform.

** 24 hourly/8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.

*** Sensitive areas may include

It is found that Rourkela – Rajgangpur area and Talcher – Angul area are receiving the maximum pollution load in terms of TSP and SO_2. Though the pollution load in Talcher is much more than the Rourkela area, the ambient air quality of Talcher – Angul area is better than Rourkela. It could be seen that the major contribution to air pollution in Talcher area is from thermal power plants (pollution load from coal mines and transport sector has not been considered in this study), whose emissions take place at an altitude of 275 m, thus has least impact on the ground level concentration.

In terms of air quality most of the industrial areas all within the low and moderate category, whereas the urban area air quality remains either high or critical. This indicates that transport is a major factor as air pollution in the state is concerned.

2.4.3 Acid Rain Potential

Acid rain occurrs due to emissions of large quantity of sulphur dioxide which get converted to sulphur trioxide favourable climatic condition and get dissolved in moisture to form acid aerosol. These, finally cause acid rain. There are three areas where sulphur dioxide emission are high i.e. Rourkela due to emission from Rourkela Steel Plant, Talcher – Angul area due to emission from thermal power plants and Paradeep due to emission from sulphuric acid plant and from phosphatic fertilizer plants. However, no incident of acid rain in Orissa has been observed. This is probably due to better atmospheric dispersion of pollutant in the environment.

2.4.4 Solid Waste

Solid waste from industrial activities is one of the major environmental concern. The problem becomes more prominent, if it is designated as hazardous waste. It has been observed that mineral based industries generate significant quantity of solid waste. It is also a difficult task to estimate solid waste generation from small scale sector. An attempt is made to quantify major solid waste which do not have any subsequent usefulness. The major solid waste are fly ash from thermal power plants, red mud from

alumina refinery, slag from iron and steel and ferro alloys plants, char from sponge iron plants and gypsum from phosphatic fertilizer plants.

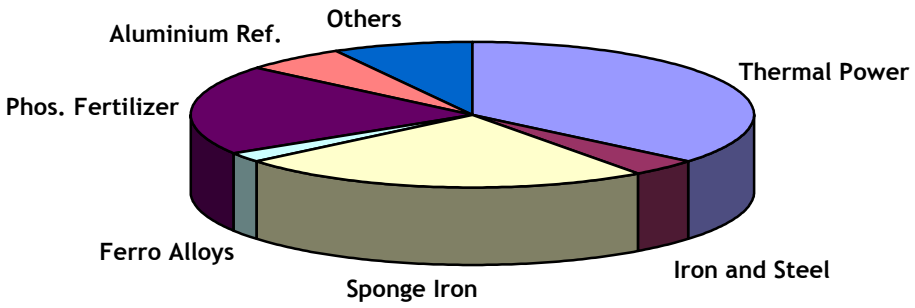
Major solid waste generation in the state is given in ***Table 2.46***.

TABLE: 2.46
Solid Waste Generation in Major Industrial Sectors

Sl.	Industrial Sector	Solid Waste	Generation (Million Ton/Annum)	Mode of Disposal
1.	Thermal Power Plant	Fly ash and Bottom Ash	9.0	Ash Pond
2.	Iron and Steel	BF Slag SMS Slag BF Flue Dust	1.0	Dumping
3.	Sponge Iron	Char Kiln Dust	6.0	Land Disposal
4.	Ferro Alloys	Slag	0.5	Secure Landfill
5.	Phosphatic Fertilizer	Gypsum Sulphur Muck	5.0	Thickened Sludge Disposal
6.	Aluminium	Red Mud	1.5	
7.	Other Sector	--	3.0	

About 25 million tons of solid waste is generated from industrial sectors in the state. Thermal power, Iron and steel including sponge iron and fertilizer are the sectors, which generate most of the solid waste. Solid waste generations from different industrial sectors are graphically presented in ***Figure 2.10***.

Figure – 2.10
Sectorwise Solid Waste Generation from Different Industrial Sectors



Land requirement for disposal of such waste vary widely depending upon the bulk density of the waste and contour of disposal site. However, assuming a mean bulk density of 2.5 T/M^3 for all the waste put together and average depth of landfill site being 10 m, every year 100 Ha of land shall be required for solid waste disposal.

Some of the wastes are designated as hazardous because of their composition and hazard potential. Hazardous waste generation in the state

as per Hazardous Waste (Management and Handling) Amended Rule 2003 has been estimated as 80,000 MT/annum. Districtwise generation of hazardous waste is presented in ***Table 2.47***.

TABLE: 2.47
District Wise Hazardous Waste Generation in Orissa

Sl.	Name of the District	Hazardous Waste (TPA)			
		Recyclable	Incinerable	Land Disposable	Total
1	Angul	1340.65	31	12944.76	14316.41
2	Balasore	1822.8	65.9	82.13	1970.83
3	Bargarh	57.8	--	1.5	59.3
4	Bhadrak	213.0	--	1.0	214.0
5	Bolangir	5.0	3.8	93.44	102.24
6	Cuttack	39.82	172.52	511.15	723.49
7	Dhenkanal	322.60	4.15	62.396	389.146
8	Ganjam	14.01	1.0	1675	1690.01
9	Jagatsingpur	110.5	--	19273	19380.5
10	Jajpur	131.5	--	721.69	853.19
11	Jharsuguda	431.56	6.5	6625.72	7063.78
12	Kalahandi	1.8	--	12.0	13.8
13	Keonjhar	102.35	--	7054.173	7156.523
14	Khurda	9.8	0.18	7.57	17.55
15	Koraput	77.5	2.0	22.846	102.346
16	Mayurbhanj	43.9	--	82.17	126.07
17	Nabarangpur	1.6	--	6.0	7.60
18	Puri	--	--	1.7	1.7
19	Rayagada	943.64	--	--	943.64
20	Sambalpur	182.75	1.8	2540.4	2724.95
21	Sundargarh	8450.87	78.2	14,602.98	23,132.05
	Total	**14,303.45**	**367.05**	**66,318.625**	**80,989.125**

2.5 Response

Iron and steel including sponge iron, thermal power, cement and fertilizer are the major industries which contribute substantially to the air pollution in the State. Besides this, stone crushers and brick kilns, though in small scale, are also major contributors of air pollution by virtue of their large number.

In iron and steel sector Rourkela Steel Plant took several measures to reduce air pollution from various units. The highly polluting type open hearth furnaces were replaced with L.D. converters with inbuilt pollution control equipments. The coke oven plants are being rebuilt in phased manner which ultimately would further reduce the pollution load at Rourkela.

Similarly, the sponge iron plants have significant potential for air pollution with emission from plant as high as 10 gm/Nm3. The State Pollution Control Board directed all the sponge iron plants to install high efficiency Electro Static Precipitator (ESP) or any high efficiency air pollution control system and prescribed stringent standard of 100 mg/Nm3 for particulate matter emission from the kilns to regulate the air pollution.

All the thermal power plants have installed ESP to control particulate matter emission. They have been directed to earmark adequate space so that flue gas desulfurisation plant can be established in case the ground level concentration of sulphur di-oxide comes close to the National Ambient Air Quality Standard. Currently, all the future thermal power plants are being directed to install high efficiency air pollution control equipments so that, the emission particulate matter will conform to 100 mg/Nm^3 against the national standard of 150 mg/Nm^3.

The older cement plants which were operating in wet process have converted to less polluting type dry process. Over and above, these plants have installed high efficiency ESPs so as to conform to stricter standard of 100 mg/Nm^3.

In fertilizer sector for gaseous pollution control in both the fertilizer plants at Paradeep have installed alkali scrubbers in the Sulphuric Acid are Phosphoric Acid Plants. All of them have installed online monitoring facility to continuously monitor the SO2 emission from the Sulphuric Acid Plants.

On the basis of notification from Government of India, operation of highly polluting type moving chimney brick kilns have been prohibited and in its place fixed chimney brick kilns are being encouraged.

In the industrial sector thermal power, pulp and paper, iron and steel and fertilizer are the major water polluting industries. All the thermal power plants in the state have adopted complete water recirculation system from the ash pond thereby substantially reducing volume of discharge and pollution load.

In iron and steel and pulp and paper industries adequate capacities of Effluent Treatment Plants (ETP) have been installed and continuous efforts are being taken to reduce the specific water consumption in these plants. Several in plant measures over the years have resulted in steady reduction in water consumption and wastewater generation. Thermal power plants are exploring the possibilities of disposing fly ash in abandoned mine pit to further minimize the pressure on land and the risk of surface water contamination. In this direction, a project by Talcher Thermal Power Station (NTPC) has already been cleared for disposal of ash in abandoned mine pit of South Balanda.

The fertilizer plants have been designed on zero discharge concepts. Talcher – Angul area, fluoride contamination of ground water was observed in 11 villages around NALCO Smelter Plant. A scheme for pipe water supply was executed to supply drinking water to these villages.

The river bed of Nandira which was carrying overflow from the ash ponds of thermal power plants was silted with ash. The entire river bed of Nandira was desilted in 2001 and now the water quality has been restored in this river which was once considered to be an industrial drain.

All the major industries which generate solid waste are being advised to explore various possibilities for utilization of solid waste.

Use of fly ash for manufacturing building materials is being promoted by proper coordination with concerned agencies.

For safe disposal of hazardous waste, a common hazardous waste disposal site is in the process of development by the State Government through IDCO near Rourkela.

Ministry of Environment and Forests, Government of India has recommended certain action plans for the industries in 17 categories of highly polluting type in consultation with the regulators and the industries association. These are called as Corporate Responsibilities for Environment Protection (CREP). The CREP recommendations are now currently being implemented in 17 categories of highly polluting type industries and are being reviewed from time to time.

The Board in collaboration with the Central Pollution Control Board has been preparing districtwise Zoning Atlas in which environmentally compatible sites are identified for future industrial development in the state. This exercise has been completed for the districts Sundargarh, Undivided Cuttack (Cuttack, Jagatsinghpur, Kendrapara and Jajpur), Undivided Sambalpur (Sambalpur, Bargarh, Jharsuguda and Deogarh), Puri, Mayurbhanj, Keonjhar, Balangir and Sonepur.

Industrial estate planning at Paradeep and Rayagada have been completed suggesting environmentally compatible industrial development, by the Zoning Atlas cell of the Board.

Regional Environmental Management Plan was prepared for Angul – Talcher area which is considered as environmentally stressed area. Carrying capacity study for Duburi and Paradeep have been carried out to regulate industrial growth in the area, considering the environmental status.

2.6 Conclusion

Though the state has large potential for industrialization, so far the level has remained rather low. Talcher – Angul and Rourkela areas contribute maximum pollution load both in terms of air and water pollution. However in these two areas the ambient air quality mostly had remained within the norms. The river water quality at the down stream of these two areas has shown contamination, apparently due to organic loads from human activities like ULBs and industrial townships. In other areas like Paradeep, Rayagada, Chandikhol and Khurda the environmental problems are mostly localized and can be mitigated with more stringent pollution control measures.