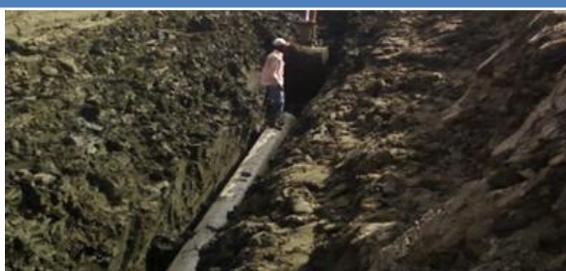


Comprehensive Environmental Pollution Abatement Action Plan Chitra Industrial Cluster Bhavnagar – Gujarat



Gujarat Pollution Control Board
Paryavaran Bhavan,
Sector-10A, Gandhinagar

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FOREWORD

Need of action plan is justified to control pollution in any area where pollution sources are identified, pollutants are measured, assessed and found exceeding permissible limits. To implement such action plans is a duty of any SPCB and all concerned agencies/stakeholders.

After declaration of critically polluted areas by OMs dated 13.1.2010 and 15.3.2010 of MoEF, GOI and imposing temporary moratorium for a period upto August 2010, the action plans for these specified areas (industrial clusters) are desired by the CPCB and MoEF, GOI.

In Gujarat, six areas – Ankleshwar, Vapi, Ahmedabad, Vatva, Bhavnagar and Junagadh – are identified by above OMs as critically polluted. GPCB started quick actions, expanded its infrastructure, decided and declared main points to control pollution at source, prepared action plans including these points and finalized the same in consultation with main stakeholders and issued necessary directions. These action plans were sent to MoEF on 19.4.2010. Meanwhile, by letters dated 19.4.2010 and 18.5.2010, CPCB suggested TOR to make the action plans. Accordingly the action plans are revised.

Consultative meetings were held with various stakeholders including the industries associations, CETP/TSDF operators, NGOs, CPCB and GIDC authorities, who have helped to improve the action plans.

We are thankful to the CPCB and MoEF to have recognized the wholehearted efforts by GPCB team, DoEF, GIDC, VW&EMCL industries of Vapi and all other concerned.

We are hopeful that this will serve the purpose and help various agencies/authorities to implement and monitor the Action Plans for the six industrial clusters/ areas of the state.

We are also hopeful that the implementation of these Action Plans would bring in the positive results in other clusters also.

Place: Gandhinagar
Date: 30-10-2010

Dr.K.U.Mistry
Chairman, GPCB

Chapter-1

Introduction

1.1 Area details

Brief history:

The History of Bhavnagar goes back a lot further than the city itself. Bhavnagar located near the Gulf of Khambhat, on a carefully chosen strategic location having potential of maritime trade. Till independence, Bhavnagar State was ruled by the Gohil Rajput clan. It begins in the 12th-13th century, when the Gohil Rajputs of the Surya Vanshi clan, facing severe competition in Marwar, moved down to the Gujarat coast and finally settled at Gogha port, near present-day Bhavnagar. Bhavnagar was founded by Bhavsinhji Gohil, the rulers of Sihor in 1723 AD. It was the time of persistent Maratha raids of the States of Saurashtra. The last princely ruler Late Sir Krishnkumarsinhji handed over the administration of his State to the people's representative in 1948 on the advice of Gandhiji. Founded as a port in 1743, Bhavnagar is still an important trading post for the cotton goods manufactured in Gujarat. The Bhavnagar lock gate keeps ships afloat in the city's port at low tide. Bhavnagar remained a major port, for almost two centuries, trading commodities with Africa, Mozambique, Zanzibar, Singapore and the Persian Gulf. This flourishing maritime trade resulted in the high rate of urbanization surplus wealth and cosmopolitan culture of the town.

Present day Bhavnagar owes much to the vision of the past ruler Sir Takhtsinhji Gohil (1869-96 AD). The town planning schemes were designed and implemented under the guidance of progressive rulers of Bhavnagar. In the post independence industrialization era, Gujarat Industrial Development Corporation (GIDC), which is a State Government undertaking for development of industrial clusters in the state, has established Chitra (Bhavnagar) cluster in year 1970. It is situated in the municipal limit of Bhavnagar Municipal Corporation (BMC), which is well connected by rail, road, sea and air to the other parts of the country.

1.2 Location:

Chitra industrial cluster encompasses total area of 173.48 hectares including industrial area- 156.968 hectares, housing complex- 10.90 hectares and commercial area - 5.60 hectares. It houses 794 industrial plots and sheds and other land use detail of the cluster is summarized in the Table-1 given below

Table-1: Land use detail of the cluster

Sr.No.	Type of Plot	Total Nos.	Allotted	Vacant
1	Industrial Plot	551	524	27
2	Industrial Shed	243	231	12
3	Housing Plot	256	186	70
4	Commercial Plots	10	10	0
5	Housing Quarters	188	178	10
6	Shops	8	8	0
7	Godown	16	12	4

Source: Project Report of CIA

Chitra industrial cluster has a potential for 794 numbers of the units, out of which 550 units are in functional state. The cluster has basic infrastructure facility such as post office, canteen, bank, Paschim Gujarat Vij Company Limited Office and its substation, Telephone exchange. Other facilities are available within few kilometers of cluster. Internal infrastructure inside the cluster needs improvement. It is having earmarked green space area of 1,12,000 Sq. mt., which is planned to be converted into green area by plantation in the forthcoming monsoon and in a phased manner. Detailed map of the cluster with delineated boundaries is enclosed herewith as Fold-1. Major concern is remains for the disposal of effluent generated by industries located within the Chitra industrial cluster.

Chitra industrial cluster has got following inherent strengths:

- Availability of labor.
- Situated at the entry of Bhavnagar City on State Highway No. 25.
- Availability of power.
- Availability of raw materials.
- Availability of city bus & auto rickshaw.
- Availability of broad gauge railway link.
- Availability of telecommunication services including internet facilities.
- Availability of connectivity with Bombay through air link.

- Availability of port in Bhavnagar and Pipavav (at 140 Km from Bhavnagar).

Chitra industrial cluster is 42 years old, which mainly accommodates small and medium scale industries. Bhavnagar being a coastal district there are many salt fields and also having Bentonite mines, which provide raw material for various chemical industries of Chitra. The details of total investment, employment, annual turnover and government revenue are given in the following table-2 for Chitra.

Table-2: Economic of the Cluster

(Rs. in crore)

Sr.No	Particulars	Present Status-2009		Projection for next-5 years-2014	
		Total for Estate	Export units Under scheme	Total for Estate	Export Unit Under scheme
1	Investment	Rs.300.00Cr	Rs.120.00Cr	Rs.650.00Cr	Rs.250.00Cr
2	Employment Nos	6500	2500	15500	4500
3	Annual Turnover	Rs.550.00Cr	Rs.210.00Cr	Rs.1525.00Cr	Rs.600.00Cr
4	Export	Rs.150.00Cr	Rs.75.00Cr	Rs.375.00Cr	Rs.200.00Cr
5	Tax	Rs.65.00Cr	Rs.20.00Cr	Rs.150.00Cr	Rs.45.00Cr

Source: Project Report of CIA

1.3 Location Map:

Map showing geographical location and Impact Zone is attached at Annexure - I

1.4 CEPI Score:

Central Pollution Control Board (CPCB) in collaboration with Indian Institute of Technology (IIT), Delhi and other institutes formulated the concept for Comprehensive Environmental Pollution Index (CEPI) and has analyzed the Environmental status of industrial clusters which were identified in consultation with the Ministry of Environment and Forests for CEPI analysis. These clusters have been classified as very critically polluted having CEPI score above 80, critically polluted having CEPI score above 70.

Chitra industrial cluster, Bhavnagar, Gujarat has been listed with CEPI score for Air CEPI 54.5, Water CEPI 57.5 and Land CEPI 57.75 with overall CEPI score as 70.99, details of which is given in the table-3 below. This score is just above the criterion for identification of cluster as critically polluted at CEPI score of 70.00 with ranking 39 in the report. Therefore a detailed Action Plan for the Chitra industrial cluster, Bhavnagar, Gujarat for prevention and control as well as remediation of various environmental components using the best available and appropriate engineering practices is a must. A comprehensive implementation mechanism including financial, manpower and technology required is to be synchronized in a time bound manner with an efficient monitoring mechanism which is necessary for bringing CEPI Score down the line.

Table-3: CEPI score for Chitra GIDC

Sub component	Basis for sub component rating	Max	Existing Score		
			Air	water	Land
A1	Based on the data on the presence of toxins	6	5.5	3	3
A2	Based on the scale of industrial activities	5	5	5	5
A	A1*A2	30	27.5	15	15
B1	Based on the pollutant concentration data (Ambient Pollutant Concentration)	8	8	7.5	7.75
B2	Based on the impact on people (Evidence* of adverse impact on people)	6	0	3	3
B3	Based on the impact on eco-geological features(reliable evidence of adverse impact on eco-geological features)	6	0	3	3
B	B1+B2+B3	20	8	13.5	13.75
C1	Based on potentially affected population)	5	3	3	3
C2	(Based on the level of exposure)	5	3	3	3
C3	Based on the risk to sensitive receptors	5	0	5	5
C	(C1*C2) + C3	30	9	14	14
D	Based on the information on pollution control facilities	20	10	15	15
CEPI	A+B+C+D	100	54.5	57.5	57.75
	Max. CEPI		57.75		
	Aggregated CEPI =		70.99		

Source: CPCB report: EIAS/5/2009-10

1.5 Total population and sensitive receptor

1. The area under study comprising of cluster and its impact zone of 2 kms from the boundary of the cluster is as shown in Annexure-II. It's geographical coverage within

Bhavnagar Municipal Corporation (BMC) area, covers the wards mainly Chitra, Fulsar, Kumbharwada and Bortalav (Population – 70,000) in the BMC. As it is covered under municipal area no separate population data is possible to collect, however an attempt has been made to get the data on ward basis. Thus the study area is approximately covering the following.

2. Population – 70,000 Chitra, Fulsar, Kumbharwada and Bortalav - Wards
3. Post Office, Canteen, Bank, G.E.B. Office, G.E.B. Sub Station, Telephone Exchange.
4. D-Division Police Station is located @ 3 KM from the Cluster.
5. B.M.C. Fire Fighting Station is located @ 5 KM from the Cluster
6. E.S.I. Hospital is located @ 4 KM from the Cluster,
7. GIDC office is located @ 4 KM from Cluster,
8. DIC office @ 5 KM from Cluster,
9. Two Primary, Secondary and Higher Secondary Schools are located within the Cluster.
10. Medical, Engineering, Polytechnic, Law, B.Ed., I.T.I., Arts, Commerce, Science etc. Colleges are available in Bhavnagar.

1.6 Eco-geological features

Chitra industrial cluster encompasses total area of 173.48 hectares including industrial area- 156.968 hectares, housing complex- 10.90 hectares and commercial area - 5.60 hectares and study area of 2 kilometer impact zone having an area of approximate area of 3000 hectares.

The Climate of the Region: The climate of Bhavnagar district is humid and warm except during brief winter (December-February). The summer (April-May) heat is oppressive with mid-day temperatures often rising above 40 C. The highest ever temperature recorded in Bhavnagar in past 70 yrs is 46.7 C in past 30 yrs. The lowest ever temperature recorded in Bhavnagar is 0.6 C in the past 70 yrs and 6.6 C in past 30 yrs. The average annual temperature in past 30 yrs ranges from 21-33.4 deg. C. However, certain areas experience extreme heat and extreme cold in summer and winter respectively.

The rainfall alone forms the ultimate source of freshwater resource to the region. Average annual rainfall recorded at Bhavnagar is about 660.8 mm as per meteorological observations. Since the study area is a part of the arid coastal tract and receives scanty rainfall, the

occurrence of drought a frequent natural phenomenon. The rain is under the influence of Southwest monsoon during June-September. The total number of rainy days however seldom exceeds 35. The maximum rainfall occurs during July-August and tapers off by the end of October.

The relative humidity annually ranges from 21-77% with maximum during the monsoon months and minimum during winter months (December-February).

The winds are mild with marked increase in speed in late summer and early monsoon season. The annual average wind speed is 10.5 km/hr. The predominant wind direction is from northeast during October- February, from southwest ring March-April and from south during May-September. Cyclones occasionally strike Saurashtra region. Under their influence the region experiences squally weather with strong winds accompanied with heavy rainfall.

Geological Pattern: The southern strip of Saurashtra coast displays variegated geomorphic features with numerous cliffs rising up to 25m islets, extensive tidal flats, deposits of littoral concrete in rocky beaches, sandy beaches and bars dunes .the coast line at the project site has vertical banks, and inter tidal area consisting of soft alluvial deposits of coarse and fine sand mixed with silt and clay. The top soil around Kalatalav is made of coast coarse saline soil poor in nutrients. Vast coastal areas get submerged during spring high tide in certain stretches.

The peninsular Suarashtra is extensively covered with Deccan Traps mainly of basalts and dolerites. The topography of the region is gently sloping toward the sea, accepting small hillocks of Milliolic limestone. The Deccan Traps forming the main land of Suarashtra is exposed over vast areas, except for a narrow coastal belt along the southwest. Quaternary formations consisting of Milliolic limestone and Alluvial are exposed along the coastline. The solubility of limestone in water is responsible for creating a Karst topography where limestone is exposed. Rock surface is pockmarked with various sizes of circular holes, cavities and caverns and rainwater percolates through these holes.

The Deccan basalts of Bhavnagar district is fringed by laterite band, which is red to lavender grey in colour fairly rich in iron, often passing into hermalite and red ocheres. Gajbeds represented by grits, sand stone, yellowish and bluish clays and marls occur near Undavi,

Piram Island and southwards from Akwada upto Mathavada. In some parts they are covered by alluvium. Most of the zone around Kalatalav has alluvial deposits and consists of sand dunes, tidal mudflats, raised beaches and freshwater alluvium.

1.6.1 Major water bodies

No sensitive receptors in terms of surface water bodies, ecologically sensitive areas etc. exist within the immediate vicinity of Chitra cluster. However, only two small ponds viz. Bor Talav and Gangajalia Talav – to name a few, exist within the city of Bhavnagar. These are approximately 6 km and 10 km respectively on the other side of cluster across the State highway No. 25 and in opposite direction of treatment and disposal system having no environmental impact on the same.

1.6.2 Ecological parks, sanctuaries, fauna and flora or any eco sensitive zone

The coast between Bhavnagar to Khambat is highly muddy and is made up of vast open onshore mudflat. This low level saline flat land represents a palaeo mudflat, locally known as Bhal area. The coastline has an indented configuration and the coastal zone morphology is characterized by mudflats, alluvial cliffs, drowned river mouths, palaeo mudflats and alluvial plains. The area experiences semi arid to dry sub-humid tropical ecoclimate. The area is falling under Semi-Arid biogeographic zone of Gujarat Rajputana biotic province having biotic province code of 4B.

The major part of the area, being covered by salt affected soils occurring under diverse agro-ecological conditions, is usually found barren and occasionally support sparse native vegetation comprising woody plants and/or hardy grass as surface cover. The natural vegetation in degraded soil affected soils is very poor and is formed of stunted and scattered species of *Prosopis juliflora*, *Acacia nilotica*, *Capparis decidua*, *Prosopis cineraria*, *Salvadora persica*, *Salvadora oleoides*, *Zizyphus nummularia*, *Tamarix ericoides*, *Kochia prostrate*, *Cassia auriculata*, *Cressa cretica*, *Cynodon dactylon* etc. The common animal species of the area includes stray deer, jackal, foxes etc. Among birds are common Painted storks and peacocks.

Forest: Velavadar National Park, the only tropical grassland in India recognized as a National park is located in Bhavnagar district, in the Bhal region of Saurashtra, Gujarat. The park, now spread over an area of 34.08 Sq.kms used to be a private grassland of the ex-princely state of Bhavnagar with an area of about 1788.88 ha which was subsequently declared as a reserve forest and later notified as a National Park in 1976. An area of 1622.23 ha was further added in 1980. The main attraction of the park located seventy-two km away from the city of Bhavnagar is the massive population of Black Buck, Antelope, Wolf and other endangered species of birds. Hence, no ecologically sensitive areas exist within the 25 km radial periphery of the cluster.

Cropping Pattern of the Region: In Bhavnagar District, food and non-food crop grown can be grouped under two main heads Kharif and Rabi. The Kharif or the rain crops are sown in June-July and harvested in October-November. The Rabi or irrigated crops are sown in September-October and harvested in February-March. The main Kharif crops in the district are Jowar, Bajri, Rice, Groundnut and Cotton while Wheat and Gram are the important Rabi crops. Jowar is grown both as Rabi and Kharif crop.

Common Flora: Many tree/woody species are planted on road-side strips, avenue and garden plants, hedge and shade trees. The common woody species used for the purpose are: *Acacia leucophloea*, *Acacia nilotica*, *Acacia tortalis*, *Azadirachta indica*, *Cordia spp.*, *Delonix elata*, *Leucaena leucocephala*, *Mangifera indica*, *Moringa Oleifera*, *tamarindus indica*, *Albizia lebbeck*, *Cassia siamea*, *Delonix regia*, *Mimosa hamata*, *Pithecellobium dluce*. Among the horticultural woody species, preferred are: *Cocos nucifera*, *Panicum granetum*, *Psidium guajava*, *Syzigium cumini* and *Terminalia cattapa*. The flora of the study area is listed in following table-4.

Table-4: Details of flora of study area

Sr. NO.	SCIENTIFIC NAME	COMMON NAME	FAMILY
GRASSES			
1	<i>Apluda mutica</i>		

Sr. NO.	SCIENTIFIC NAME	COMMON NAME	FAMILY
2	<i>Aristida adscensionis</i>	Lapdu	Poaceae
3	<i>Cynodon dactylon</i>	Dab	Cyperaceae
4	<i>Dactyloctenium aegyptium</i>		Poaceae
5	<i>Dicanthium annulatum</i>	Jinjvo	Poaceae
SHRUBS			
6	<i>Abutilon glaucum</i>		
7	<i>Calotropis procera</i>	Aak	Asclepiadaceaea
8	<i>Capparis congesta</i>	Karaunda	Capparaceae
9	<i>Capparis sepiaria</i>		Capparaceae
10	<i>Leptadenia reticulata</i>		
11	<i>Euphorbia nerifolia</i>	Dandathor	Euphorbiaceae
12	<i>Zizyphus nummularia</i>		Rhamnaceae
13	<i>Cassia auriculata</i>	Anwal	Caesalpinaceae
14	<i>Cressa cretica</i>	Luni	Convolvulaceae
15	<i>Zizyphus mauritiana</i>	Ber	Rhamnaceae
16	<i>Sesbania grandiflora</i>		Eakad
TREES			
17	<i>Alianthus excelsa</i>	Maharuk	Simarubaceae
18	<i>Acacia nilotica</i>	Babul	Mimosaceae
19	<i>Prosopis cineraria</i>	Khejri	Mimosaceae
20	<i>Prosopis juliflora</i>	Mesquite	Mimosaceae
21	<i>Salvadora persica</i>	Piludi	Salvadoraceae
22	<i>Salvadora oleoides</i>	Mithi Piludi	Salvadoraceae
23	<i>Acacia tortilis</i>	Israeli Babul	Mimosaceae
24	<i>Aegle marmelos</i>	Bel	Rutaceae
25	<i>Capparis decidua</i>	Kerdo	Capparaceae

Source: Report of NIO for CIA

Common Fauna: The common animal species of the area includes stray deer, jackal, foxes etc. Among birds are common Painted storks and peacocks. The details of the faunal species found the study area are listed in the following table-5.

Table-5: Details of fauna of study area

Sr. NO.	SCIENTIFIC NAME	COMMON NAME	LOCAL NAME
Mammals			
1	Lepus nigricollis ruficaudatus	Bufous tailed hare	Sasalo
2	Lepus nilgrocollis Dayanus	Desert hare	Sasalo
3	Canis lupus pallipes	Wolf	Naar, Varu
4	Canis aureus	Jackal	Shiyal
5	Vulpes bengalensis	Fox	Lonkadi
6	Herpestes edwardsi	Grey mongoose	Noliyo
7	Boselaphus tragocamelus	Blue bull	Rojh, Nilgai
8	Sus scorfa	Indian Wild boar	Suar, Bhund
9	Funambulus pennati	Five stripped palm,	Khiscoli
10	Merioned hurricanae	Desert gerebille	Ghus
11	Tatera indica	Indian gerebille	Ghus
12	Felis chaus	Jungle cat	Jungli bilado
13	Suncus murinus	Grey musk shrew	Chachundar
Reptiles			
14	Calotes versicolor	Common garden lizard	Kachindo
15	Hemidactyles alaviviridis	House gecko	Garoli
16	Mabuya carinata	Common skink	Nagni mashi
17	Varanus benglensis	Common Indian monitor lizard	Patlagho
18	Echis carinatus	Saw scaled viper	Padaku
19	Bangarus calruleus	Krait	Kalotro
20	Naja naja	Cobra	Nag

Source: Report of NIO for CIA

Fisheries Activity of the Region: Length of the coast of Bhavnagar district is 152 km. having 16 fishing port. Total population of fishermen in Bhavnagar district is 8061 and they have 194 boats for fishing purpose. Fisheries production of the district

is 4668 MT/year. Common fish species found in the Bhavnagar district are given in following table-6.

Table-6: Common Fish Species

SR. NO.	COMMON NAME
1.	Lobster (Titan)
2.	Prawn (Zinga)
3.	Palafish (Palva)
4.	Shark (Magra)
5.	Bumla Fish
6.	Levta
7.	Crabs
8.	Kanti
9.	Mullet (Boi)

Source: Report of NIO for CIA

1.6.3 Building or monuments of historical/archeological/religious importance

The total industrial area is 156.968 hectare, housing complex is of 10.90 hectare and commercial area is 5.60 hectare, thus total area is 173.48 hectare which includes 794 industrial plots and sheds. The cluster is covered by rail track on eastern side, state highway no on western side while Bhavnagar main city is on southern side and village Vartej on the northern side. There is no major habitation/agriculture and industrial activity on the eastern side while on the western side and northern side is a thinly populated area with no industrial activity.

The Industrial Cluster has following amenities:

1. Post Office, Canteen, Bank, G.E.B. Office, G.E.B. Sub Station, Telephone Exchange.
2. D-Division Police Station is located @ 3 KM from the Cluster.
3. B.M.C. Fire Fighting Station is located @ 5 KM from the Cluster
4. E.S.I. Hospital is located @ 4 KM from the Cluster,
5. GIDC office is located @ 4 KM from Cluster,
6. DIC office @ 5 KM from Cluster,

7. Two Primary, Secondary and Higher Secondary Schools are located within the Cluster.
8. Medical, Engineering, Polytechnic, Law, B.Ed., I.T.I., Arts, Commerce, Science etc. Colleges are available in Bhavnagar.

Hence, in terms of habitation as a sensitive receptor in the area, the cluster has 256 nos of housing plots, 10 commercial plots, 188 Housing quarters, and 24 nos. of shops/ godown. It also houses other receptors like temples and schools within the cluster.

1.7 Industry classification

Out of 550 functional units, total 120 units are having pollution potential and falling under the categories, which are required to obtain Consents/ Authorization from the GPCB. Industries located in this cluster are bifurcated depending on the pollution potential of the unit as red, orange and green. These are 60 nos in the red category, 32 in orange category and 28 in the green category. Based on investment criteria, 116 small, 2 medium and 2 large scale units are located within the cluster. Details of these industries are given in table 7 & 8 given below.

Table-7: Bifurcation of industries based on pollution potential

Industry Type	Red	Orange	Green
Any other/miscellaneous	9	1	12
Bakery products, biscuits confectionery.			1
Chemicals & products	19	8	
Corrugated boxes		1	
Dyes and dye-intermediates.	2		
Electroplating / metal finishing	5		
Food & agriculture			2
Food including fruits and vegetable processing.		2	
Foundry plants	6		
Iron and steel	2		
Milk processing and dairy products	1	0	1
Miscellaneous-orange		7	
Miscellaneous-red	15		
Ore/mineral industrial Plants		9	
Pharma-formulation		2	
Plastic processed goods			9

Pulverizing units		1	
Rubber goods industry			2
Small scale industry			1
Stone quarries		1	
Textiles	1		
TOTAL	60	32	28

Source: GPCB June, 2010

Table-8 Bifurcation of industries based on size of the unit

Industry Type	Small	Medium	Large
Any other/miscellaneous	22		
Bakery products, biscuits confectionery.	1		
Chemicals & products	25		2
Corrugated boxes	1		
Dyes and dye-intermediates.	2		
Electroplating / metal finishing	5		
Food & agriculture	2		
Food including fruits and vegetable processing.	2		
Foundry plants	6		
Iron and steel	2		
Milk processing and dairy products	2		
Miscellaneous-orange	7		
Miscellaneous-red	13	2	
Ore/mineral industrial Plants	9		
Pharma-formulation	2		
Plastic processed goods	9		
Pulverizing units	1		
Rubber goods industry	2		
Small scale industry	1		
Stone quarries	1		
Textiles	1		
TOTAL	116	2	2

Source: GPCB June, 2010

1.7.1 Highly polluting industries (17 categories)

From the above details it is evident that no such industries covered under the list of 17 categories industries which are criteria for highly polluting industry as per CPCB for large/medium scale units. Thus the density of the industry per 10 km² area will be less than 2 nos of R 17 category unit which falls under moderate category for calculation of factor A1.

1.7.2 Red category industries (54 categories)

There are total 60 nos. of units falling under red category. Comparing with the details of criteria for 54 red category industries there are 17 no of units falling under this criteria, while remaining are not covered under this criteria for 54 category units. These all are small scale in nature. Thus the density of the industry per 10 km² area will be less than 10 R 54 category units which fall under moderate category for calculation of factor A1.

1.7.3 Orange and Green category industries

Out of total 120 units in study area, there are 32 units falling under orange category and 28 units falling under green category which does not have significant pollution load.

1.7.4 Grossly polluting industries

There is no grossly polluting industry in this estate and thus estate does not have significant role towards pollution at large for the entire component of Air, Water and Land.

Chapter-2

Water Environment

2.1. Present status of water environment supported with minimum one year analytical data-:

Source of water for Bhavnagar city as well as Chitra industrial cluster is from Khodiyar and Shetrunji Dam and through pipeline of Gujarat Water Infrastructure Limited (GWIL) from the river Mahi and Narmada. The industries in the cluster having pollution potential are mainly engaged in the manufacturing of Chemical, Mineral processing, Foundry, Steel re-rolling etc. The total supply of water in the cluster 2.5 MLD having 1.2 MLD from BMC and 1.3 MLD from GWIL. Bhavnagar being located on coastal belt, it is not dependent on ground water because of hydro geological condition.

No sensitive receptors in terms of surface water bodies, ecologically sensitive areas etc. exist within the immediate vicinity of Chitra cluster. However, only two small ponds viz. Bor Talav and Gangajalia Talav – to name a few, exist within the city of Bhavnagar. These are approximately 6 km and 10 km respectively on the other side of cluster across the State highway No. 25 and in opposite direction of treatment and disposal system having no environmental impact on the same.

2.1.1. Water bodies/ effluent receiving drains in the area important for water quality monitoring-:

There is no water body of significant importance in the cluster as well as in the study area of impact zone, however effluent stream coming out of the cluster ground water and water in the sea creek are major area of importance for water quality monitoring. The location identified for the monitoring are as under.

Monitoring of effluent quality (once in a month)

1. Outlet of estate 2 nos.
 - a. Drain named Dhandhalia Nala
 - b. Drain near Hot mix Plant
2. After confluence with domestic effluent 2 Nos.
 - a. Drain named Dhandhalia Nala
 - b. Drain near Hot mix Plant
3. Near final outlet (After Commissioning of pipeline)

Monitoring of Ground Water quality (once in a month)

Existing location at plot no 290 in the premises of Das Pendawala to be continued and no proposal for increasing numbers of station.

2.1.2. Present levels of pollutants in water bodies/ effluent receiving drains/ ground water (routine parameters, special parameters and water toxics relevant to the area in three categories - known carcinogens, probable carcinogens and other toxics)

Industrial effluent quality at receiving bodies within the estate: Pollution load is quantified at identified four numbers of locations having discharge of effluent from Chitra for the parameters of **COD, TDS,SS, Oil & grease, NH3-N, Chloride, & Sulfate**, details of which is summarized as under.

Table-9: Present levels of pollutants in effluent receiving drains in GIDC estate, Chitra

Point 1- Dhandhalia Nala								
Parameters	Permissible Value	Result 1	Result 2	Result 3	Result 4	Average Mg/Lit	Discharge Load Kg/ Day	Impact
Flow of waste water 60% OF 1.5 MLD= 0.9 MLD								
TDS	In Fluent TDS 22.7 to 31.3 PPT	37825	1256	9552	27821	19113.5	17202.15	No
SS	100 &10%> Influent: 136 to 13439	30	112	70	46	64.5	58.05	No
Ammonical Nitrogen (mg/l)	50	10.08	9.9	10.08	8.5	9.64	8.676	No
Chloride (mg/l)	-	16495	500	4199	1296	5622.5	5060.25	No
Sulphate (mg/l)	-	698	71	143	550	365.5	328.95	No
COD (mg/l)	250	105	86	95	133	104.75	94.275	No
O&G (mg/l)	20	2.4	2	2.4	3.2	2.5	2.25	No
Point 2- Near Hot mix Plant								
Flow of waste water 40% OF 1.5 MLD= 0.6 MLD								
TDS	-	22887	18069	24886	3934	17444	10466.4	No
SS	100 &10%>	86	30	50	132	74.5	44.7	No

	Influent: 136 to 13439							
NH3-N	50	8.4	7.04	1.07	11.04	6.8875	4.1325	No
CL	-	9997	7898	10897	1699	7622.75	4573.65	No
SO4	-	406	315	415	89	306.25	183.75	No
COD	250	143	105	124	114	121.5	72.9	No
O&G	20	5.2	2	3.6	2.8	3.4	2.04	No

Source: GPCB

Sewage effluent quality from Bhavnagar City: Pollution load from the city sewage is monitored in terms of general parameters and summarized below:

Table-10: Present levels of pollutants in effluent generated from City Sewage

Location of Sampling point	Kansaranala, Kansarabridge, Bhavnagar						
	Samp ID & Dt	BOD	COD	Colour	NH3	O&G	pH
Permissible Values Marine Disposal	100	250	100	50	20	6.5to8.5	100
September/2010	106.8	301	20	8.6	3.2	7.81	12.8
August/2010	39.7	191	10	8.4	4.8	7.75	11.2
July/2010	42	232	20	6.16	7.2	7.03	8.58
June/2010	36	219	25	5.88	7.6	6.82	8.96
May/2010	99	276	25	5.6	4.0	8.01	8.12
April/2010	106	305	25	6.16	8.8	7.08	8.96
March/2010	60	275	20	5.88	6.8	7.26	8.58
Frb./2010	59	245	25	5.6	6.4	6.93	8.42
Janu/2010	63	204	25	4.9	4.8	7.15	8.56
Dece/2009	91	239	10	8.6	5.2	7.55	14.2
Nov./2009	23	210	25	4.76	4.4	7.84	8.40
Oct/2009	60	172	50	7.56	4.8	6.86	NAH
Sept/2009	76	317	25	23.52	6.0	6.91	0.00
Aug/2009	96	343	10	42.56	7.2	7.17	NAH
July/2009	95	275	50	8.4	4.0	8.31	12.8
June/2009	42	149	50	8.4	6.0	8.01	12.8
May/2009	111	318	50	7.56	6.0	7.88	14.2
April/2009	21	96	50	8.4	8.0	7.98	1.12
March/2009	46	286	20	6.16	4.4	7.96	8.96
Feb/2009	54	228	25	1.12	5.6	6.96	2.86
Jan/2009	26	142	25	2.52	7.6	6.9	56.80
Sept/2008	52	231	20	30.8	6.0	7.02	32
Aug/2008	45	220	20	28.56	8.0	7.06	1.12

Source: GPCB

Looking to the results it can be said that the city sewage has marginally higher COD at few occasions.

Present level of pollutants in drain before mixing and after confluence with domestic sewage at outfall of Chitra is summarized in table no 11 to 14

Table – 11 W/w sample of GIDC Chitra before mixing with domestic w/w near Dhandhaliya nallah

Samp ID & Dt	BOD	CHL	COD	COL	NH3	O&G	pH	S.S	SUL	TDS	TMP
Sep/2010	21.6	4399	78	5	22.96	1.6	8.34	82	4393	21090	28
Aug/2010	28.2	6698	87	5	11.76	2.4	8.94	82	245	14580	33
Jul/2010	40.1	1699	114	50	11.04	2.8	8.8	132	89	3934	35
June/2010	24.3	4199	95	35	10.08	2.4	8.78	70	143	9552	31

Source : GPCB

Table-12 W/w sample of GIDC Chitra before mixing with domestic w/w near Hot mix plant near vadila nallah

Samp ID & Dt	BOD	CHL	COD	COL	NH3	O&G	pH	S.S	SUL	TDS	TMP
Sep/2010	31.9	1100	117	10	18.48	2.8	8.49	72	215	3256	27
Aug/2010	26.4	11896	78	5	9.52	2.8	9.2	122	189	26982	31
Jul/2010	37	12096	133	25	8.5	3.2	9.1	46	550	27821	35
June/2010	36.1	10897	124	30	8.07	3.6	9.03	50	415	24886	30

Source: GPCB

Table-13 W/w sample of GIDC Chitra after mixing with domestic w/w near Hot mix plant near vadila nallah

Samp ID & Dt	BOD	CHL	COD	COL	NH3	O&G	pH	S.S	SUL	TDS	TMP
Sep/2010	68.8	120	194	10	10.64	3.6	7.94	128	34	1472	28
Aug/2010	30.1	980	113	5	20.72	3.2	8.13	118	105	2332	32
Jul/2010	78.3	900	257	50	21.04	7.2	7.61	148	75	2145	35

June/2010	61.2	1100	210	55	20.08	6.8	7.39	154	85	2607	30
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Source: GPCB

Table-14 W/w sample of GIDC Chitra after mixing with domestic w/w near Dhandhaliya nallah

Samp ID & Dt	BOD	CHL	COD	COL	NH3	O&G	pH	S.S	SUL	TDS	TMP
Sep/2010	25.8	800	97	10	12.32	2	8.07	142	819	4038	28
Aug/2010	18.3	5798	61	5	22.96	2	8.63	156	219	13620	30
Jul/2010	61.6	1999	200	60	19.9	6	8.5	172	95	4607	35
June/2010	77.8	4998	267	80	21.06	7.6	8.93	220	145	11315	31

Source: GPCB

Groundwater Quality:

The results of ground water quality monitored by GPCB at GIDC cluster, Chitra are mentioned at Annexure 2. That figures indicate that the levels of all the parameters are within the permissible levels of drinking water as specified in IS: 10500.

2.1.3. Predominant sources contributing to various pollutants

- a) Industrial Effluent (inorganic in nature) from the GIDC Chitra Estate
- b) Domestic Waste Water from nearby residential areas of Bhavnagar city.

2.2. Sources of water pollution

Surface water: The major effluent generating industries in Chitra GIDC area are from the inorganic sector. Hence, the major criteria pollutants considering the nature of the industry and quality of effluent being discharged by them are pH, TDS, Chlorides and Sulphates. Moreover, other water pollutants like DO, BOD, nitrate, nitrite, ammonia, dissolved phosphate, and phenols can be considered due to ultimate disposal of effluent in sea creek. Besides the treated effluent discharged by industries located in the cluster does not have significant contribution towards these parameters.

Ground water: Though groundwater levels in the cluster show levels within desirable range, the area of Bhavnagar falls under the critical area as per the criteria of CGWA. Moreover to the lower levels of water table, the salinity ingress also results in higher levels of TDS in the groundwater in the region of Bhavnagar. Hence, Chlorides, Sulphates and Total Hardness can be considered as critical parameter for the groundwater environment, being a coastal area.

2.2.1. Industrial

Chitra Industrial cluster is mainly housing marine chemical industries, which generates the effluent mainly inorganic in nature. Hence, the major parameter of concern in the effluent is Dissolved Salts, Chlorides and Sulphates.

2.2.2. Domestic

Sewage of some of the residential areas like Chitra, Fulsar etc of Bhavnagar city passes through GIDC Chitra.

2.2.3. Others (Agricultural runoff, leachate from MSW dump, illegal dump site etc.):

No such other sources exist in the Chitra GIDC Estate and in surrounding.

2.2.4. Impact on surrounding area (outside the CEPI Area) on the water courses/ drainage system of the area under consideration:

The effluent ultimately goes to the sea creek in intertidal area and getting mixed with sea water. As such there is no impact on surrounding area (outside CEPI area) at present.

2.3. Details of Water Polluting Industries in the area/ cluster

Mainly units manufacturing magnesium carbonate, silica, electroplating (negligible discharge-non cyanide process) and plastic recycling (reuse) are the main water polluting industries in the estate of Chitra. The characteristics of effluent from the major effluent generating industries area are ranging as follows - pH ranges from 6.5-8.5, TSS ranges from 100-200 mg/l, TDS ranges from 5000-15000 mg/l, NH₃-N ranges from 20-40 mg/l, Salinity ranges from 2000-6000 mg/l, COD and BOD levels are found below 100 mg/l

and 30 mg/l respectively. There are no significant pollutants except for TDS, Chloride, Sulphates, and BOD and COD to some extent. However looking to the treatment in oxidation pond and disposal in creek will not have much impact on the environment.

2.4. Effluent Disposal Methods– Recipient water bodies etc.

The industries discharging 1.35 MLD of wastewater from their process/ utilities in Chitra industrial cluster are only from inorganic chemical manufacturing sector. All the units have installed individual Effluent Treatment Plants (ETPs). Earlier this effluent was discharged through underground drainage and surface drain having ultimate disposal in to creek. Presently due to ongoing work of conveyance, treatment and disposal scheme, it is diverted through surface drain having ultimate disposal in to creek. Except for the internal conveyance within the estate, rest of work is almost completed. The domestic effluent from industries and other within the cluster is being disposed through septic tank and soak pit.

2.5. Quantification of wastewater pollution load and relative contribution by different sources viz industrial/ domestic

Chitra Industrial cluster generates industrial effluents of 5180 KLD from different industries with their raw materials mainly consisting of salt derived products mostly inorganic in nature and contains mainly sodium sulphate, sodium chloride, aluminum chloride and magnesium carbonate, where as Bhavnagar Municipal Corporation generates the domestic sewage of 15000 KLD consisting of organic waste .The combined effluent thus amounts to 20180 KLD diluting and balancing each other by inorganic and organic constituents.

For the effluent disposal project, a projection of total of 5.0 MLD Effluent of Chitra Industrial cluster and 15 MLD Domestic Waste from Bhavnagar Municipal Corporation Area i.e. total 20 MLD was thought for the Chitra industrial cluster and its surrounding. The calculated load of effluent stream from estate is mentioned in the table-9 (para 2.1.2).

2.6. Action Plan for compliance and control of pollution

2.6.1. Existing infrastructure facilities –water quality monitoring network, ETPs, CETPs, Sewerage Treatment Plant of industry (STPs), surface drainage system, effluent conveyance channels/ outfalls etc.

Water quality monitoring network: GPCB monitors water quality at four locations for GIDC Chitra viz 2 nos of waste water samples of Dhandhalia Nallah (before and after mixing of industrial effluent of GIDC Chitra with domestic waste water of nearby residential areas) and 2 nos of waste water samples of Vadila Nala (before and after mixing of industrial effluent of GIDC Chitra with domestic waste water of nearby residential areas). GPCB also monitors water quality from the outlet of ETP of units generating waste water periodically. Also ground water is being monitored at one location within the cluster at plot no 290 at Das Pendawala having their own primary ETP.

ETP/ STP for industries: Effluent generating industries have their own ETPs and all industries are having their own septic tank/ soak pit for disposal of domestic waste water.

CETP: The effluent generating industries are very few in number and inorganic in nature. Each has its individual ETP for treating the wastewater generating from their premises. Hence, a Common effluent treatment facility is not required for this cluster.

Surface drainage system, effluent conveyance channels/ outfalls: For domestic w/w open surface drain is passing through GIDC Chitra and industrial w/w is conveyed through existing u/g pipeline of Chitra Industrial Association up to railway nallah which is being now replaced by ongoing project of collection, conveyance, treatment and disposal.

2.6.2. Pollution control measures installed by Industries

Industries are having their own domestic/industrial effluent treatment plants. Domestic effluent is being discharged through septic tank and soak pit.

Industrial effluent is being treated for primary parameters like pH, SS and TSS.

Chemical industries located in Chitra are giving inorganic effluent hence their action points are water related which are as under.

1. Providing flow meter
2. Membership of common collection, conveyance, treatment and disposal pipeline.
3. Single Outlet.
4. Providing easily approachable sampling point.

2.6.3. Technological Intervention

2.6.3.1. Inventorisation of prominent industries with technological gaps

The effluent generating industries are very few in number and inorganic in nature. Each has its individual ETP for treating the wastewater generating from their premises. Hence, a Common effluent treatment facility is not required for this cluster. Prominent industries generating major quantity of effluent are identified in Chitra Industrial Cluster having discharge more than 25 KL per Day are summarized in table-15.

Table – 15 list of chemical industries having water pollution potential (>25 KLPD)

Sr No	Name of industry	Qty of effluent in KL/day	Main Product
1	Madhu Silica Pvt. Ltd. (EOU)	332.50	Precipitated silica
2	Madhu Silica Pvt. Ltd. (DU-III)	161.00	Precipitated silica
3	Madhu Silica Pvt Ltd (DU)	130.00	Precipitated silica
4	Elite Chemicals	31.70	Magnesium Carbonate
5	Madhu Silica Pvt. Ltd.	264.41	Precipitated silica

6	Melox Chemicals	39.50	Magnesium Carbonate
7	Par Drugs & Chemicals Pvt Ltd	136.50	Magnesium Hydroxide
8	Priti Industries	36.00	Magnesium Carbonate
9	Usha Chemicals	41.60	Magnesium Carbonate
10	Jil Chemicals	38.50	Magnesium Carbonate

All the above-mentioned prominent industries have individual functional and adequate ETPs for meeting the GPCB norms.

2.6.3.2. Identification of low cost and advanced cleaner technology for pollution control

As mentioned earlier, the treatment of industrial wastewater is not a problem in the estate, as is the disposal. For treatment of sewage effluent from the Bhavnagar City, the BMC has constructed oxidation ponds for treatment of waste water because of cost constraint. However it has planned for an advanced cleaner technology STP with Govt. grant.

2.6.4. Infrastructure Renewal

2.6.4.1. Details of existing infrastructural facilities

For domestic w/w open surface drain is passing through GIDC Chitra and industrial w/w is conveyed through existing u/g pipeline of Chitra Industrial Association.

2.6.4.2. Need of up gradation of existing facilities

The existing effluent collection conveyance treatment and disposal is inadequate hence individually treated effluent is required to be conveyed at a suitable point after treatment. To achieve this it is proposed by association of the industries to collect convey and to treat effluent in to oxidation pond along with partial city sewage for treatment in the oxidation pond with ultimate disposal into the sea creek at a point approved by National Institute of Oceanography (NIO). The project is under implementation and the treatment and

disposal facilities are completed, while modification of conveyance system in the cluster is under progress and likely to be completed by December 2010.

2.6.4.3. De-silting of water tanks, drains, rivulets, etc.

As there is no surface water system which require de-silting.

2.6.4.4. Construction of lined drains/ connections

The project of collection conveyance treatment and disposal of the treated effluent in the oxidation pond along with partial city sewage is having a component of conveyance through pipeline only; hence there is no need for lining of the drainage system.

2.6.4.5. Treatment and management of contaminated surface water Bodies

The effluent generated from the cluster is finding its way through the natural drain beyond railway nallah which is further reaching to sea creek through natural drain, which has effluent comprising mainly of inorganic nature and domestic sewage. There is no surface water body which is found contaminated.

2.6.4.6. Rejuvenation/ Management Plan for important eco-geological features

There is no significant eco geological damage observed in an area. The project of collection conveyance treatment and disposal of the treated effluent in the oxidation pond along with partial city sewage is having a component of conveyance through pipeline will stop the disposal of effluent in to marine environment through surface drain.

2.6.4.7. Carrying of effluent from industrial units located in non-industrial locations to CETP facilities by lined drains/pipelines only and prevention of their disposal into city sewerage/ surface drains.

The project of collection conveyance treatment and disposal of the treated effluent in the oxidation pond along with partial city sewage is having a component of conveyance through pipeline.

2.6.4.8. Installation of Gen sets at CETPs

There is a inherent provision for the ongoing project for the generator set for the emergency purpose.

2.6.5. Managerial and Financial aspects

2.6.5.1. Cost and time estimates

The Proposal for collecting, conveyance, treatment and final disposal of effluent from Chitra Industrial estate and BMC is under PPP model wherein Bhavnagar Municipal Corporation is participate agency for this project. It has initial estimate of Rs. 3.59 Crores, subsequently it was revised with a tune of Rs. 3.59 Crores and finally sanctioned to Rs. 9.73 Crores.

The treatment and disposal facilities are almost completed, while modification of conveyance system in the cluster is under progress and likely to be completed by December 2010.

2.6.5.2. Identified Private/ Public sector potential investors & their contribution/ obligation

The project implementation is sanctioned from various aids/grants available from government agencies and clearance from Indian Railway and Government of Gujarat including GPCB. It is contemplated to complete the construction of all project components within a period of 12 months from March 2010. Services of multiple agencies are also planned to complete the project. It is approved to implement the project under ASIDE scheme through a Special Purpose Vehicle (SPV) formed by the Chitra Industries Association, which will carry out the business of developing the infrastructure facilities with participation of Bhavnagar Municipal Corporation, while operating and maintaining the infrastructure facility is to be looked after by Bhavnagar Municipal Corporation with participation of Chitra Industries Association. This arrangement will also ensure the creation of the useful assets and sustainability through an appropriate revenue generation mechanism. This project is under Assistance to State for Developing Export Infrastructure And Allied Activities (ASIDE), CETP Scheme having financial out lay as per table-16

Table - 16

ASIDE Scheme	50%
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CETP Scheme	25%
BMC	15%
CIA	10%

2.6.5.3. Government Budgetary support requirement

A contribution of 90% is from government bodies for the above-mentioned project and the project is already sanctioned and under implementation.

2.6.5.4. Hierarchical and structured managerial system for efficient implementation

Services of multiple agencies are also planned to complete the project. It is approved to implement the project under ASIDE scheme through a Special Purpose Vehicle (SPV) formed by the Chitra Industries Association, which will carry out the business of developing the infrastructure facilities with participation of Bhavnagar Municipal Corporation, while operating and maintaining the infrastructure facility is to be looked after by Bhavnagar Municipal Corporation with participation of Chitra Industries Association. This arrangement will also ensure the creation of the useful assets and sustainability through an appropriate revenue generation mechanism.

2.6.6. Self monitoring system in industries (ETPs etc.)

The industries in the cluster are generating effluent inorganic in nature which does not have significant pollutants that require rigorous monitoring except for the hydraulic load and suspended solids. Some of the industries have self monitoring facilities; however CIA will ensure that a common monitoring team will be developed for periodical monitoring if required in future.

2.6.7. Data linkages to SPCB/ CPCB (of monitoring devices)

The Gujarat State Pollution Control Board already has a facility for online data maintenance related to industrial records and monitoring records vide their online XGN facility.

However, in furtherance, the possibility of direct data acquisition linkages from the monitoring devices itself can be thought of and may be taken up with xgn manager i.e. NIC, Gandhinagar.

Chapter-3

Air Environment

3.1. Present status of Air environment supported with minimum one year analytical data

The industries generating air pollution are mainly either chemical industries with no chemical process emission having utility installation like boilers/ thermic fluid heaters etc. (having Particulate Matter - PM, Oxides of Sulphur and Oxides of Nitrogen as pollutant) or Bentonite based mineral processing industries (having PM as pollutant). The main air pollutants of concern are PM/ PM₁₀ and PM_{2.5} (a recent amendment to the National Ambient Air Quality Standards - NAAQS).

Some of the industries have installed the adequate air pollution control devices such as dust collectors/ bag filters. However, few are required to install the same particularly in small scale sector. There are no major organic chemical industries, which can have process emissions. The contribution to air emissions is mainly from the flue gas. Coal excluding Lignite and Wood are the major fuels used in the utility installations like Boiler, TFH etc. Coal excluding Lignite is usually being used in medium and large scale industries and wood mainly in the small scale sector. Further, Bentonite based mineral processing industrial units also contribute to the Particulate Matter emission in the ambient air. Air pollutants like PM - represented as PM₁₀/ PM_{2.5}, SO₂ and NO_x are likely to be emitted from the above and can be considered as the key indicator pollutants. PM₁₀ and PM_{2.5} can be considered as indicators for the air environment.

3.1.1. Critical locations for air quality monitoring

Looking to the area and prevailing monitoring station there is a need of two monitoring station which is fulfilled and presently following ambient air quality monitoring stations are in operation

- 1) Gautam Buddha Prathmik School No 55 and 56, Village: Fulsar (Once in a month) - New Stations
- 2) Madhu Silica Pvt Ltd (R&D) Centre, GIDC Chitra for PM_{2.5} (Once in a month) - New Stations
- 3) Siddhi Silica Pvt Ltd, GIDC Chitra (Twice a week) - Existing

3.1.2. Present levels of pollutants in air (routine parameters, special parameters and air toxics relevant to the area in three categories- known carcinogens, probable carcinogens and other toxic)

The results of ambient air quality monitored at GIDC cluster, Chitra during 2007 to 2010 for criteria pollutants of SPM, RSPM, SO_x and NO_x are given below:

Suspended Particulate Matter (SPM)

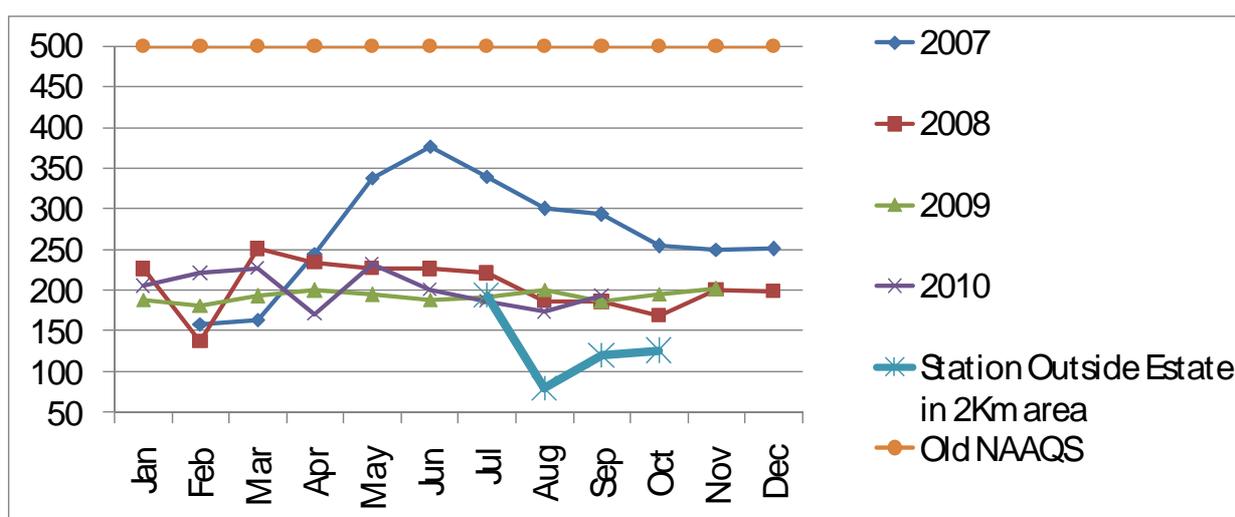
The levels of SPM were found to be within the permissible levels of 500 µg/m³ designated for industrial area as per the old NAAQS. It is noteworthy that SPM as a parameter has been removed from the NAAQS in the new notification in 2009.

Table - 17 : SPM

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007		158	163	245	338	377	340	300	293	254	250	251
2008	226.1	136.83	250.58	234	226.71	226.17	221.07	186.17	185.63	169.23	200.06	198.53
2009	188.38	180.79	192.73	199.75	194.29	187.8	191.54	200.83	185.96	195.63	201.33	
2010	205	221	227	171.13	231.87	200.71	187.21	172.83	193.50			
Station outside estate in 2 Km area, year 2010							193	79	120	126		
Old NAAQS	500	500	500	500	500	500	500	500	500	500	500	500

Note: all results are in µg/M³

Source: GPCB



Source: GPCB

Respirable Suspended Particulate Matter (RSPM)

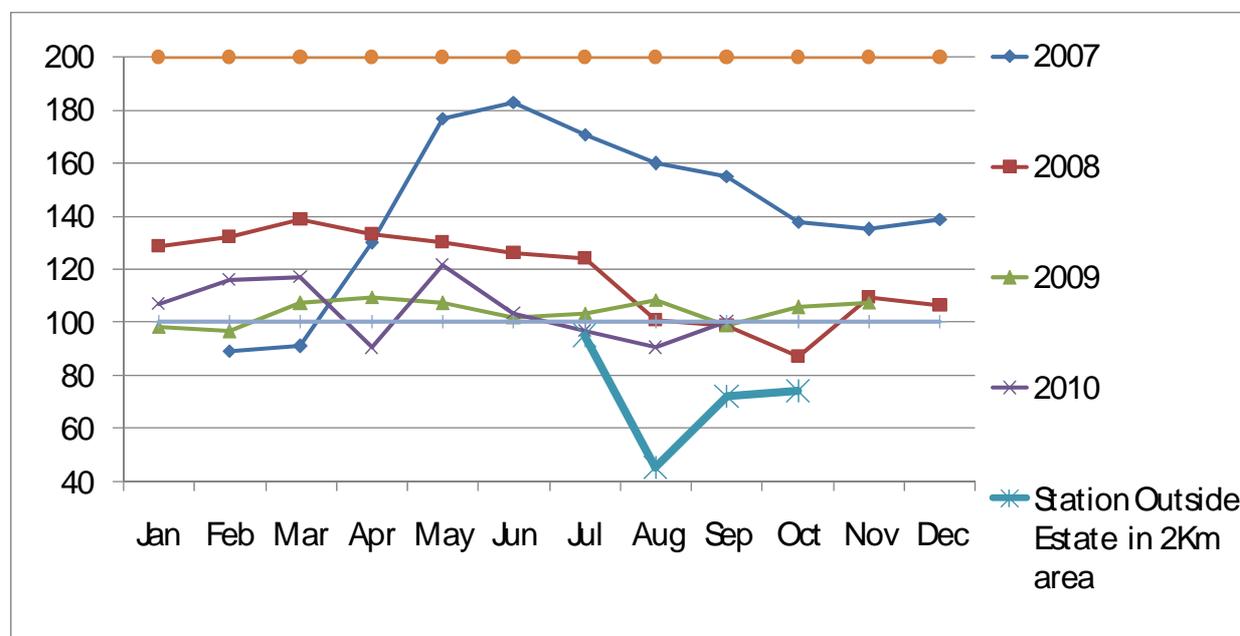
The levels of RSPM i.e. PM10 were found to be within the permissible levels of 200 µg/m³ designated for industrial area as per the old NAAQS. However, on comparison to the prevailing NAAQS, they are found to be slightly higher than the acceptable levels of 100 µg/m³, which is an area of concern.

Table – 18 : RSPM

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007		89	91	130	177	183	171	160	155	138	135	139
2008	128.6	132.17	138.79	133.3	130.38	126.08	124.03	100.83	98.8	87.2	109.61	106.53
2009	98.25	96.46	107.17	109.38	107.21	102	103.38	108.3	98.79	105.67	107.57	
2010	107	116	117	90.38	121.77	103.33	96.63	90.37	100.38			
Station outside estate in 2 Km area, year 2010							95	45	72	74		
Old NAAQS	200	200	200	200	200	200	200	200	200	200	200	200
New NAAQS	100	100	100	100	100	100	100	100	100	100	100	100

Note: all results are in µg/M³

Source: GPCB



Source: GPCB

Sulphur dioxide

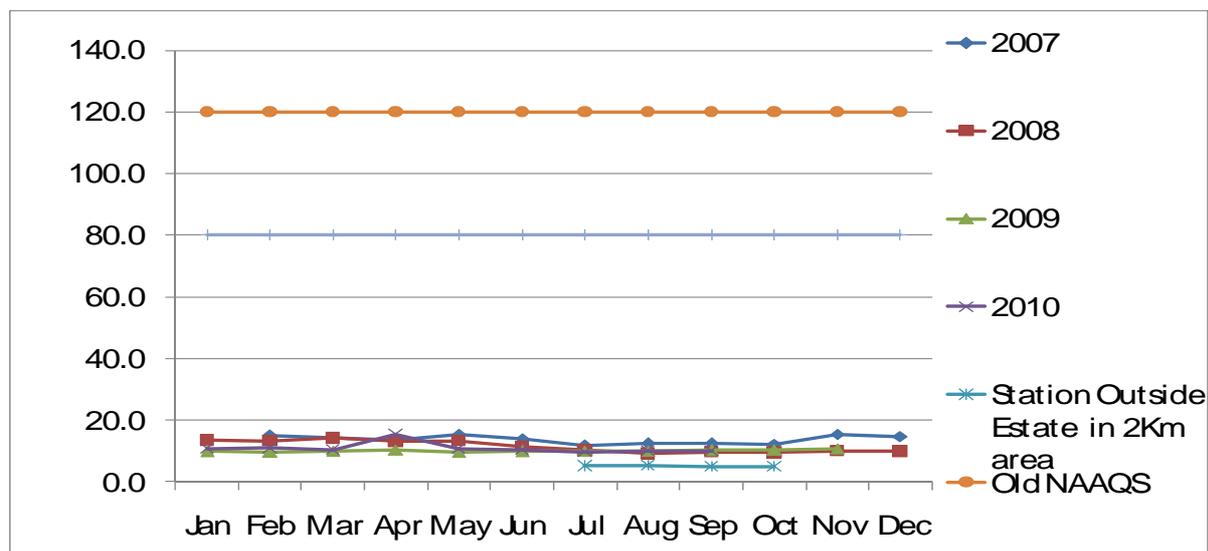
The levels of SO₂ in the ambient air are way below the old as well as prevailing NAAQS levels of 120 µg/m³ (for industrial area) and 80 µg/m³ respectively.

Table – 19 : SO₂

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007		14.9	14.2	13.6	15.3	14.0	11.6	12.3	12.3	12.2	15.4	14.5
2008	13.4	13.2	14.1	13.0	13.2	11.4	10.2	9.1	9.5	9.4	9.9	9.8
2009	9.7	9.6	10.0	10.2	9.5	9.7	9.9	9.9	10.1	10.4	10.6	
2010	10.6	10.8	10.4	15.44	10.6	10.36	9.57	9.92	10.00			
Station outside estate in 2 Km area, year 2010							5.07	5.21	4.93	4.8		
Old NAAQS	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
New NAAQS	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

Note: all results are in µg/M³

Source: GPCB



Source: GPCB

Oxides of Nitrogen

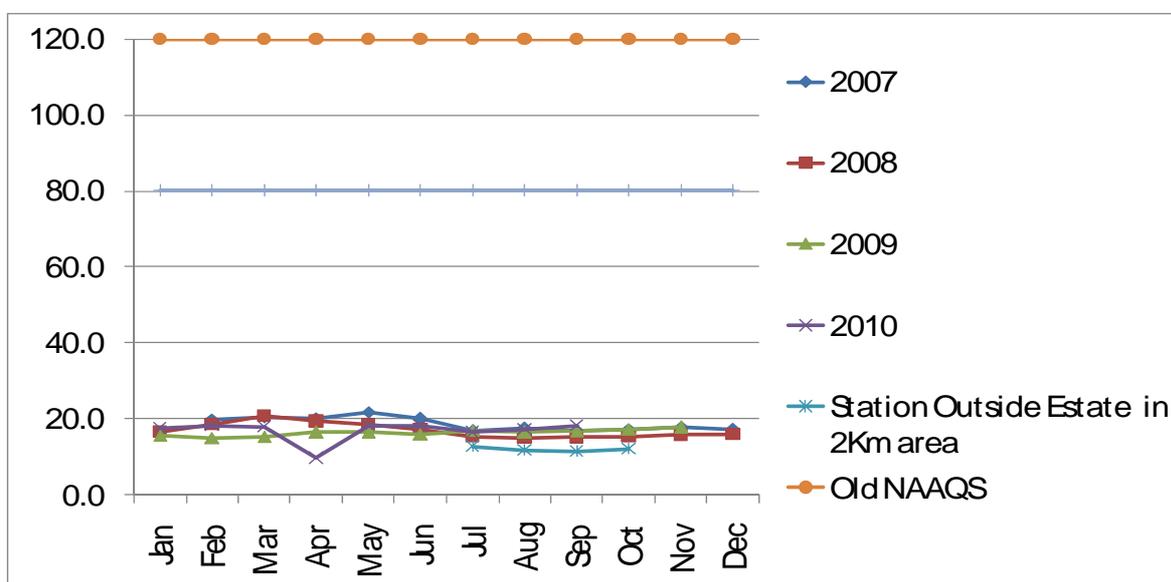
The levels of NO_x in the ambient air were found below the old as well as prevailing NAAQS levels of 120 µg/m³ (for industrial area) and 80 µg/m³ respectively.

Table – 20 : NO_x

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2007		19.7	20.4	20.0	21.7	19.8	16.7	17.3	16.9	17.2	17.7	17.0
2008	16.6	18.4	20.8	19.3	18.3	17.2	15.1	14.8	15.1	15.3	15.7	15.9
2009	15.4	15.0	15.2	16.3	16.3	15.8	16.8	16.4	16.7	17.1	17.6	
2010	17.5	18	17.7	9.49	18.0	17.9	16.9	17.1	18.1			
Station outside estate in 2 Km area, year 2010							12.5	11.6	11.2	11.9		
Old NAAQS	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
New NAAQS	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0

Note: all results are in µg/M³

Source: GPCB



Source: GPCB

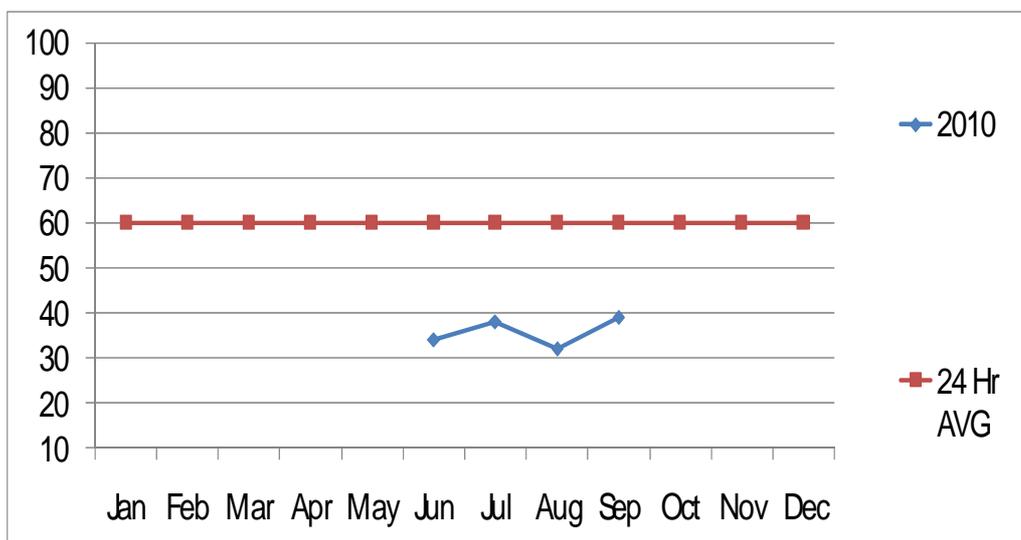
Table - 21 PM_{2.5}

Month	PM _{2.5} µg/M ³	Permissible value
July-2010	34.0	60 µg/m ³
August-2010	38.0	
September-2010	32.0	
October-2010	39.0	

Note: all results are in µg/M³

Source: GPCB

The levels of PM 2.5 in ambient air were found within permissible levels 60 µg/m³. It was measure Max. of 39 µg/M³ in the month of October-2010



Source: GPCB

Special parameters and air toxics relevant to the area in three categories- known carcinogens, probable carcinogens and other toxic:

It is noteworthy that the cluster is not contributing significantly towards the parameters like HC (methane/ non-methane), VOC, Benzene, Benzo-pyrene etc.

3.1.3. Predominant sources contributing to various pollutants

The contribution to air emissions is mainly from the flue gas emissions in the estate. Coal excluding Lignite and Wood are the major fuels used. Further,

Bentonite based mineral processing industrial units also contribute to the Particulate Matter emission in the ambient air.

3.2. Sources of Air Pollution viz industrial, domestic (Coal & Biomass burning), natural and Transport & Heavy Earth Movers

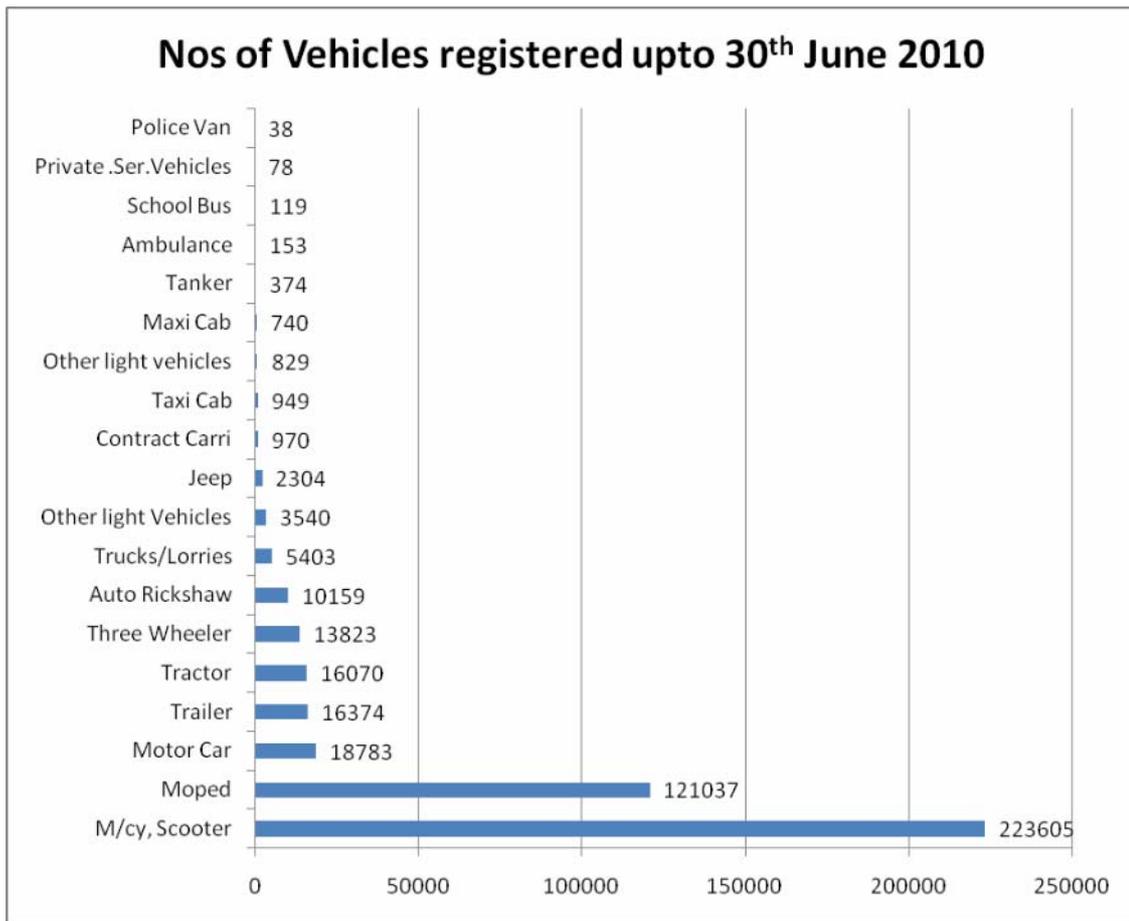
Industrial sources: There are no major organic chemical industries, which can have process emissions. The contribution to air emissions is mainly from the flue gas.

Coal excluding Lignite and Wood are the major fuels used in the utility installations like Boiler, TFH etc. Coal excluding Lignite is usually being used in medium and large scale industries and wood mainly in the small scale sector. Further, Bentonite based mineral processing industrial units also contribute to the Particulate Matter emission in the ambient air.

Air pollutants like PM - represented as PM_{10} / $PM_{2.5}$, SO_2 and NO_x are likely to be emitted from the above and can be considered as the key indicator pollutants.

Domestic sources: With adequate supply and availability of fuel for domestic needs, no bio-mass, wood or cow-dung burning is observed in the region.

Vehicular/ Transport emission sources: Details of vehicle registration data of Bhavnagar district with trend analysis is as under. In the district it is evident that majority of traffic is of two wheelers like moped/ motorcycle/ scooter which has less impact than the diesel driven vehicles. From the information gathered from RTO, in the city of Bhavnagar no major vehicular traffic affecting the ambient air quality at Chitra, because major road is only on one side of the estate and on the other side no development across the railway track. While on remaining two sides one is having residential area and on other has mix commercial area with less density of traffic. With regard to fuel adulteration action are being taken by RTO, Police and Civil Supply department from time to time.



Moreover, clean fuel for vehicles is being supplied through 4 nos of LPG stations located at following locations in the city. 1 no of IOCL at Iscon, 2 nos of Relience at Vartej & Nari, 1 no of AGIS at old Octroi Naka , in the Bhavnagar.

3.3. Air Polluting Industries in the area/ cluster

There are no organic industries in the cluster, which can have chemical process emissions. The contribution to air emissions is mainly from the flue gas. Coal excluding Lignite and Wood are the major fuels used in the utility installations like Boiler, TFH etc. Coal excluding Lignite is usually being used in medium and large scale industries and wood mainly in the small scale sector (having PM, Sox and NOx as pollutant). Moreover, Bentonite based industrial units also contribute to the Particulate Matter in the ambient air. Details of the fuel consumption in the estate are in table 22.

Table – 22 : FUEL

Sr No	Fuel	Quantity in MT
Liquid fuel		188.988
1	LDO	54.238
2	Diesel	5.316
3	FO	122.434
Solid fuel		5.894
4	Coal	2.873
5	Coke	3.021

It can be noted from the observed ambient air levels that the levels of SO₂, NO_x and PM_{2.5} are very well within the norms and only Particulate Matter represented as PM₁₀ are the parameters of concern.

3.4. Impact of activities of nearby area on the CEPI Area

The cluster is covered by rail track on eastern side, state highway no on western side while Bhavnagar main city is on southern side and village vartej on the northern side. There is no major habitation/agriculture and industrial activity on the eastern side while on the western side and northern side is a thinly populated area with no industrial activity. Thus the nearby area which can contribute in the ambient air is the residential and commercial area located on western and southern area which is only from vehicles. No other activities observed which can contribute to the CEPI score of the area.

3.5. Quantification of the air pollution load and relative contribution by different sources

The source apportionment study will be carried out through reputed institute like NEERI, IIT etc. however it is noted that Chitra cluster is has no significant pollution potential except for RSPM & SPM.

3.6. Action Plan for compliance and control of pollution

3.6.1. Existing infrastructure facilities – Ambient air quality monitoring network

Ambient air quality station are monitored at 3 stations

1. Gautam Buddha Prathmik School No 55 and 56, Village: Fulsar (Once in a month) - New Stations
2. Madhu Silica Pvt Ltd (R&D) Centre, GIDC Chitra for PM_{2.5} (Once in a month) - New Stations
3. Siddhi Silica Pvt Ltd, GIDC Chitra (Twice a week) - Existing

3.6.2. Pollution control measures installed by the individual sources of pollution

The industries generating air pollution are mainly those having utility installation like boilers/ thermic fluid heaters etc. using coal and wood as fuel (having Particulate Matter - PM, Oxides of Sulphur and Oxides of Nitrogen as pollutant) or Bentonite based mineral processing industries (having PM as pollutant). The main air pollutants of concern are PM/ PM₁₀ and PM_{2.5} (a recent amendment to the National Ambient Air Quality Standards - NAAQS). Some of the industries have installed the adequate air pollution control devices such as dust collectors/ bag filters. However, few are required to install the same particularly in small scale sector.

3.6.3. Technological Intervention

3.6.3.1. Inventorisation of prominent industries with technological gaps

With the large/ medium scale industries having adequate air pollution control devices like dust collectors/ bag filter for arresting particulate matter, the small scale Bentonite based mineral processing units are the major ones contributing the ambient air quality levels. Adequate air pollution control devices need to be provided to such units after proper technical studies. List of Bentonite based mineral processing units is in table 23.

Table – 23: LIST OF BENTONITE MFG UNITS

Sr No	Name of industry	APCM cost in lacs
1.	Mahek Agro mineral P.Ltd.	3.00
2.	Mineral & Metal Industries	3.00

3.	Benton Chem Industries, 397/2,398,399, GIDC, Chitra	0.68
4.	M.D.Corporation, 381/5, GIDC Chitra	1.55
5.	Mahavir Minerals Corporation, 381/2 GIDC, Chitra	0.42
6.	Mineral Grinding, 298, GIDC Chitra	0.52
7.	Varteji Chemicals, 259, GIDC, Chitra	0.45
8.	Mineral India, C-1/4/94, GIDC Chitra	2.00
9.	Siddharth Minerals P.No:227 GIDC Chitra	0.52
10.	Contractor Minerals, 100, GIDC Chitra	0.70
11.	Kumar M.Shah, 129, GIDC, Chitra.	0.45
12.	Bharat Mine Chem Ind, 110 PH-II, GIDC, Chitra	0.40
13.	Shreeji Mineral Industries, P.No. 240, GIDC, Chitra, Bhavnagar.	0.58
14.	Jay Khodiyar Mineral Industries, 241, GIDC ,Chitra	0.47
15.	Gujarat Mine Chem, Plot no.234,235, GIDC Chitra	0.60
TOTAL INVESTMENT		15.34

3.6.3.2. Identification of low cost and advanced cleaner technology for air pollution control

The identification of proper technology can only be done after proper technical studies for identification of sources of emissions from the process of these Bentonite processing units. The equipments identified are cyclone, multi cyclone, bag filter and scrubber. The identified measures for control of air pollution are as under for Bentonite processing units.

Action plan of Bentonite Industry

Industries have submitted undertaking to take following measures for control of Air Pollution by 31st December 2010

- 1 Ramp shall be constructed at the place of unloading from truck which shall be fixed/ Movable in nature to minimize dropping height which will avoid dusting during unloading.
- 2 Raw material pit shall be covered to avoid dusting during lifting through bucket elevator.

- 3 Raw material silo shall be covered and provided with air vent and dust collector to avoid dusting during raw material storage.
- 4 Raw material vibratory screen shall be kept in close cover and provided with air vent and dust collector to avoid dusting during screening.
- 5 Inlet at product vibratory screen shall be widened and kept at a position with minimum dropping height and reduced slope.
- 6 They shall use only authorized fuel as per consent.
- 7 Stack attached to kiln shall be provided with dust collection system like cyclone, bag filters, dust collection chamber etc.
- 8 Dust collected during manufacturing and operation of Air Pollution Control System shall be stored in bags.

3.6.3.3. Introduction and switch over to cleaner fuel

The industries have expressed willingness to switch over to the cleaner fuel like CNG whenever made available to the Chitra GIDC. At present CNG is not available in Bhavnagar.

3.6.4. Need of infrastructure Renovation

3.6.4.1. Development of roads

Development of roads is considered in the CIA project. The length of the road to be constructed within the estate is 17 km, it will be completed by the end of January - 2011 at the cost of Rs. 650 Lacs funded under CIP scheme of Govt of Gujarat.

3.6.5. Impact on CEPI score after installation/ commissioning of full fledged air pollution control systems

The CEPI score is expected to reduce considerably after adoption of proper technology for control of PM10/ PM2.5 which are the parameters of concern with respect to ambient air.

3.6.6. Managerial and Financial aspects- Cost and time estimates

3.6.6.1. Cost and time estimates

As the air pollution control equipments to be installed at individual sources is depending upon the nature and type of the industries with quantum of pollution being emitted in the air. Therefore it is not

possible at this stage for cost estimation however the deadline fixed for submission of action plan is 31st December, 2010 and the installation of air pollution control measures is 30th September, 2011. The unit which does not require any modification or up gradation required to submit the adequacy certificate in this regard having the same deadline. The total expenditure estimate is Rs 81.94 lacs which includes the cost of existing APCM. The Bentonite based units has this expenditure Rs 15.34 lacs.

3.6.6.2. Identified Private/ Public sector potential investors & their contribution/ obligation

Air pollution control activity is mainly depending on individual source control and hence no such investment is sought for however government agencies working in the field of CP and CT can share the knowledge in this regard.

3.6.6.3. Government Budgetary support requirement

The cost of air pollution control measures is to be borne by individual industries hence no such funding is required however CIA is of the opinion has welcome the scheme of financial assistance to the individual industry for air pollution control measures.

3.6.6.4. Hierarchical and structured managerial system for efficient implementation

The air pollution in the cluster needs to be controlled through individual sources of the industry which can be achieved through rigorous monitoring and self discipline.

3.6.7. Self monitoring system in industries (Stacks, Air Pollution Control Devices)

Most of the industries carry out their stack monitoring sampling through GPCB registered agencies; moreover GPCB regularly monitors the industries and also take flue gas emission samples. APCDs are installed and rectified by industries as and when suggested by GPCB.

3.6.8. Data linkages to SPCB/ CPCB (of monitoring devices)

The Gujarat State Pollution Control Board already has a facility for online data maintenance related to industrial records and monitoring records vide their online XGN facility.

However, in furtherance, the possibility of direct data acquisition linkages from the monitoring devices itself can be thought of and may be taken up with xgn manager i.e. NIC, Gandhingar.

Chapter-4

Land Environment (Soil & Groundwater)

4. LAND ENVIRONMENT (Soil and Ground Water)

4.1. Soil contamination

4.1.1. Present status of land environment supported with minimum one year analytical data

There is no historical record of any illegal dumping of hazardous waste in the GIDC cluster of Chitra. Moreover, the municipal waste is also managed by the BMC at its Municipal Solid waste disposal site. The hazardous waste inventory at the cluster is also very low. Hence, no significant issues exist related to the Soil environment. And therefore no soil samplings are carried out.

4.1.2. Critical locations for land/ soil pollution assessment and ground water monitoring

There are no critical locations for land/soil pollution in the GIDC cluster of Chitra and every month bore well water sample is collected from GIDC Chitra (Das Pendawala P Ltd, GIDC Chitra) by GPCB.

4.1.3. Present levels of pollutants in land/soil and ground water (routine parameters, special parameters and water toxics relevant to the area in three categories – known carcinogens, probable carcinogens and other toxics)

As there are no critical locations for land/soil pollution, soil sampling and analysis are not carried out. In case of ground water, one bore well water sample is carried out from GIDC cluster of Chitra (Das Pendawala P Ltd, GIDC Chitra) every month by GPCB and the results are given as Annexure - 2.

4.1.4. Predominant sources contributing to or posing danger of pollution of land and ground water such as hazardous/toxic wastes or chemicals dumps/storage etc.

There is no historical record of any illegal dumping of hazardous waste in the GIDC cluster of Chitra. Moreover, the municipal waste is also managed by the BMC at its Municipal Solid waste disposal site. The hazardous waste

inventory at the cluster is also very low. Hence, there are no sources contributing to or posing danger of pollution of land and ground water such as hazardous/toxic wastes or chemicals dumps/storage in GIDC cluster of Chitra.

4.1.5. Sources of Soil Contamination

There are no sources of Soil Contamination.

4.1.6. Types of existing pollution

In the present industrial configuration in the cluster is such that no toxic or hazardous waste is generated except for inorganic residues from primary effluent treatment plant adopted by inorganic chemical industries and others. The generated waste is being disposed through the land fill sites located outside the district and within the state. Looking to the presently available landfill infrastructure in the state there is no possibility for contamination of land with toxicant.

4.1.7. Remedies for abatement, treatment and restoration of normal soil quality

There is no need for abatement, treatment and restoration of normal soil quality as the soil is already normal.

4.2. Ground water contamination

4.2.1. Present status/ quality of ground water

One bore well water sample is carried out from GIDC cluster of Chitra (Das Pendawala P Ltd, GIDC Chitra) every month by GPCB and the results are given as Annexure-2.

That figures indicate that the levels of all the parameters are within the permissible levels of drinking water as specified in IS: 10500.

Though groundwater levels in the Chitra industrial cluster show levels within desirable range, the area of Bhavnagar falls under the critical area as per the criteria of CGWA. Moreover to the lower levels of water table, the salinity ingress near the coastal region of Bhavnagar also results in higher levels of

TDS in the groundwater in the region of Bhavnagar. Hence, Chlorides, Sulphates and Total Hardness can be considered as critical parameter for the groundwater environment, being a coastal area.

4.2.2. Source Identification (Existing sources of Ground water Pollution)

Industrial waste water and domestic waste water from residential areas like Chitra, Fulsar etc flow partly through open channel and partly through pipe line within GIDC and after mixing ultimately goes to sea creek through Vadilalah. So combined effluent may be the source of ground water pollution at present.

Moreover, the lower levels of water table may result in salinity ingress near the coastal region of Bhavnagar

4.2.3. Ground water quality monitoring program

Borewell water sample is collected from GIDC Chitra (Das Pendawala P Ltd) on monthly basis by GPCB

4.2.4. Action Plan for control of pollution including cost / time aspects

As such there is no action plan is required for the land environment as there is no waste dumped in the surroundings. However as a matter of concern to avoid illegal transpiration and dumping and to reduce, recover, reuse and recycle the waste generated from the industry needs to be managed in a sustainable manner. For better management of the waste following are the action points are identified.

Table - 24

Sr No	Activity	Issue	Action	Implementing Agency
Checking of illegal transportation and dumping of Hazardous waste	Illegal dumping of hazardous waste posing problem of surface and ground water pollution. This is not persistent in the Chitra due to inorganic industries in the majority,	Constant vigilance require to be kept on illegal: <ul style="list-style-type: none"> • Transportation • Dumping 	Individual industries, CETP, CIA, GPCB (Help from RTO can be taken for transportation issue)	This is not persistent in the Chitra due to inorganic industries in the majority, However, it is ongoing process.
Adoption of 4-R's (Reduce, Recover, Reuse, Recycle)	It is required to adopt 4-R's for better management of Hazardous waste.	Inventorying of the various solid/ Hazardous wastes generated from the industries	GPCB, Concern industries, CIA, GCPC	31.12.2010
	Industrial units need to be trained towards cleaner fuel and cleaner technology for cleaner production.	Organizing series of workshop and seminars.	GPCB, Concern industries, CIA In consultation with GCPC/ NPC/ NCPC	Starting from 30.6.2010

4.2.5. Treatment and management of contaminated ground water bodies, etc.

At present not applicable

4.2.6. Impact on CEPI score after abatement of pollution

CEPI score after abatement of pollution will be reduced.

4.3. Solid waste Generation and management

4.3.1. Waste classification and Quantification

4.3.1.1. Hazardous waste

The majority of the units in the cluster are inorganic in nature and hence the major waste generated from individual ETPs is inorganic in nature having sludge containing residues from product only which is reprocessed as low grade product while other is sent for disposal in to common landfill facilities. There is no Treatment Stabilization & Disposal Facility (TSDF) site for the industrial cluster in the area. The individual industries at Chitra have obtained the memberships of TSDF sites located at Vatva, Naroda, Vadodara, Ankleshwar and Surat as per their individual convenience. As regards to the other wastes like used oil and discarded containers, the used oil is sent to registered recyclers within Bhavnagar and very small generators are reusing the same for lubrication of machineries, while discarded containers are sent to various authorized scrap vendors or sent back to the supplier for reuse.

4.3.1.2. Bio-medical waste

In the district of Bhavnagar there are total 854 nos of health care facilities (HCF) of which 363 are bedded and 491 are non bedded. Amongst the total 854, 66 are bedded government HCF and rest 788 HCF are in private sector having 307 bedded and 481 non bedded HCF. If consider bed classification, there are 2 government HCFs having more than 200 beds, while 4 government HCU and 5 Private HCU having beds in the range of 50 to 200. And HCFs having less than 50 beds are 62 and 302 in government and private sector respectively. The total capacity of beds in the district is 4788. In the Bhavnagar City there are 411 HCFs having 251 private and 12 governments non bedded and 144 private and 04 government bedded HCFs with total 2491 beds. Thus city is having almost 50% of beds in the district.

CBWTF was established at Bhavnagar in the year 2003, which is operated by IMA at GMB Godown No. 111/F, Old Bunder, Bhavnagar. which is reasonably far away from residential and sensitive area nearly 10kms from city. This is the first community hospital waste incinerator with the capacity of 100kg/hr. It collects 3.2 to 3.5 tons per Month of Biomedical Waste (BMW) from Bhavnagar District. The details of treatment given to the bio medical waste are autoclaving, shredding and incineration. The quantity of bio medical waste generated from the above HCF's is approximate 450 kg per day of which 350 kg/day Incinerable and 100 kg/day is going for autoclaving and out of this 150 kg/day is going for shredding.

At present Bio-medical waste generating hospitals do not exist in the cluster. However, the Bio-medical waste generated from the ESI hospital near the cluster is being sent along with other medical centers of the Bhavnagar city to the common bio-medical waste disposal facility at Bandar road, Bhavnagar, managed by BMWMC-IMA having valid Authorization.

4.3.1.3. Electronic waste

There is no major E-waste generation potential in the cluster, considering the nature of the existing industries.

4.3.1.4. Municipal solid Waste/ Domestic Waste/ Sludges from ETPs/ CETPs/ STPs and other industrial sources

Municipal Solid Waste: As GIDC falls within the Bhavnagar Municipal Corporation, Bhavnagar city has population of 5.11 lacks (as per 2001 census) having per capita generation about 400 Grams per capita per day, which generates 200MT/ Day municipal solid waste. Area covered under collection of waste is 53.40 square Km. with 159000 of dwelling units using 100 trolleys (0.38M3), 279 Containers (2.5M3), 06 Dumpers, 618 hand carts and 150 litter

collectors. This is being transported using adequate numbers of vehicles.

Almost 99% of waste is collected by BMC i.e. approximately 198MT/Day. The collected MSW is disposed by Composting and pellets: 189 MT/Day (Project under implementation by M/s Hanjer Biotech Energy Private Ltd.) remaining organic waste generated from fruit and vegetable market is disposed by Organic Waste Converter supplied by Excel Crop Care Limited, Mumbai. At present waste disposed in existing land fill sites is 189 MT/Day. The site is located at village: Vadva, Nari Road, Bhavnagar, approximately 5 kms. away having area of 112 Acres with valid Authorization. The BMC has made proposal for improvement in MSW management by purchasing two sweeper machines and 16 Temple Bell tractor-Trailer.

Sewage Treatment Plant (STP): Bhavnagar Municipal Corporation at present is not having STP, Old STP is not functional. They are under planning to establish new STP for city sewage with 30 MLD capacities for which pre feasibility report is awaited; the same will be submitted to Government for grant. The management of the sewage in Chitra is being done by BMC, as of now, individual industries have septic tank-soak pit system for treatment and disposal of domestic waste.

It is however planned to treat the sewage from the cluster as well as from the city, in oxidation ponds, in present situation for Chitra cluster, partial city sewage from Fulsar and Chitra ward, Desainagar, Hadanagar, Indiranagar & surrounding of Chitra estate is proposed to be conveyed & treated under ongoing scheme of GIDC, BMC and CIA along with other industrial effluents generating from the cluster and it's ultimate disposal into the sea creek via common effluent disposal project of CIA. Presently city sewage finds its way through Kumbharvada pumping station & Kansara nallah having ultimate

disposal into the Bhavnagar creek. Sludge generated is being used as manure.

Individual Waste from ETPs: The waste generated from individual ETPs is inorganic in nature having sludge containing residues from product only, which is either reprocessed as low grade product while other is sent for disposal in to common landfill facilities. There is no Treatment, Stabilization & Disposal Facility (TSDF) site for the industrial cluster in the area. The individual industries at Chitra have obtained the memberships of TSDF sites located at Vatva, Naroda, Vadodara, Ankleshwar and Surat as per their individual convenience.

4.3.1.5. Plastic waste

There is no major plastic waste generation potential in the cluster, considering the nature of the existing industries, however plastic waste is recycled by plastic recycling units in the GIDC Chitra.

4.3.1.6. Quantification of wastes and relative contribution from different sources

As such there are no solid wastes that can contribute ground water and the soil in the GIDC Chitra.

4.3.2. Identification of waste minimization and waste exchange options

Fine bentonite clay is generated during sieving of the bentonite granules. The same can be sent back to the mining area for mine reclamation otherwise it may be utilized in some other more useful manner to avoid any air pollution in the area due to escape of air borne particles into the environment.

4.3.3. Reduction/ Reuse/ Recovery/ Recycle options in the co-processing of wastes.

Some of the inorganic waste generated from silica manufacturing units is sludge containing residues from product only, which is reprocessed as low grade product. As regards to the other wastes like used oil and discarded

containers, the used oil is sent to registered recyclers within Bhavnagar while some discarded containers are sent back to the supplier for reuse.

4.3.4. Infrastructure facilities

4.3.4.1. Existing TSDF/ Incineration facilities including capacities

Considering the quantum and nature of waste in the estate, at present such facilities are not required in Chitra GIDC.

4.3.4.2. Present status/ performance and need of up gradation of existing facilities including enhancement of capacities

Municipal Solid Waste (MSW)

As GIDC falls within the Bhavnagar Municipal Corporation, Bhavnagar city has population of 5.11 lacks (as per 2001 census) having per capita generation about 400 Grams per capita per day, which generates 200MT/ Day municipal solid waste. Area covered under collection of waste is 53.40 square Km. with 159000 of dwelling units using 100 trolleys (0.38M³), 279 Containers (2.5M³), 06 Dumpers, 618 hand carts and 150 litter collectors. This is being transported using adequate numbers of vehicles.

Almost 99% of waste is collected by BMC i.e. approximately 198MT/Day. The collected MSW is disposed by Composting and pellets: 189 MT/Day (Project under implementation by M/s Hanjer Biotech Energy Private Ltd.) remaining organic waste generated from fruit and vegetable market is disposed by Organic Waste Converter supplied by Excel Crop Care Limited, Mumbai. At present waste disposed in existing land fill sites is 189 MT/Day. The site is located at village: Vadva, Nari Road, Bhavnagar, approximately 5 kms away having area of 112 Acres with valid Authorization.

The BMC has made proposal for improvement in MSW management by purchasing two sweeper machines and 16 Temple Bell tractor-Trailer.

4.3.4.3. Treatment and management of contaminated waste disposal sites, etc.

No such site exists in Chitra GIDC.

4.3.4.4. Impact on CEPI score after proper management of Solid Wastes.

The CEPI score for Land environment is reduce due to proper management of Solid Wastes.

Chapter-5

PPP Model

5. PPP Model

5.1 Identification of project proposals (for both the options i.e. technology intervention and infrastructure renewal) for implementation under the PPP mode under the Action Plan.

Warranting the need for collecting, conveyance, treatment and final disposal in sea creek having effluent pipeline of 14 Kms length having initial project cost of Rs.3.59 Crores, a project of 5.0 MLD Effluent of Chitra Industrial cluster and 15 MLD Domestic Waste from Bhavnagar Municipal Corporation Area i.e. Total 20 MLD was thought for the Chitra industrial cluster and its surrounding.

This was thought with prime objective of protecting environment and later to implement action plan and to enable the member units to enhance their exports, resulting into increase in industrial activity that may contribute a great deal in increase of investment, employment, turnover and export, resulting in higher revenue for the State and Central Government. The details of the proposed scheme are as under:

The proposal is under PPP model wherein Bhavnagar Municipal Corporation is participate agency for this project. It has initial estimate of Rs. 3.59 Crores, subsequently it was revised with a tune of Rs. 3.59 Crores and finally sanctioned to Rs. 9.73 Crores.

Project Outline

Part-1: Pipeline from industries to Kumbharwada pumping station

RCC NP₃ 300 mm to 600 mm dia Under Ground common effluent line is proposed within GIDC Chitra cluster considering future expansion in roadside nearby compound wall of the industries. RCC NP₃ 600 mm dia. Under Ground common effluent line is proposed outside GIDC Chitra cluster from Vadi Nala to Kumbharwada Pumping Station.

To minimize nos. of Railway crossing, it is proposed to allow BMC sewage in proposed 600 mm dia. line from Vadi Nala railway crossing point. Where as BMC will lay U/G drainage line from Nari Railway crossing onwards from there source. Necessary consent

is already conveyed by GPCB for combined effluent i.e. sewage of BMC & Chitra cluster.

Manhole are proposed at every 25.0 Mt c/c with RCC frame & top cover. Ventilating column are proposed at every 1000 Mt c/c. Considering topography of cluster there will be no problem of minimum velocity.

Vortex flow meter insertion type with totaliser & flow indicator is proposed to monitor the flow quantity of effluent.

Part -2: Pumping machinery/ Power supply/ DG set: Considering 5.0 MLD effluent of GIDC Chitra cluster, 30 HP mud pump are proposed at Kumbharwada pumping station. Detention period is considered as 30 min. & storage / pump-room of existing BMC will be utilised as consented by BMC. For normal pumping Two pumps 30 HP are required. So considering 1 No. complete set stand by, total 3 nos. pumps are proposed with 100 HP power connectivity at pumping station. To avoid interruption in pumping during power supply failure DG set is also proposed with capacity of 125 KVA.

Part -3: Oxidation pond and its Approach road: For final collection an oxidation pond for 25.0 MLD is proposed near Nari having geographical coordinate Lat 21°47'38.8" N and Long 72°05'34.6" E for which land is proposed to be made available by BMC on lease. Considering detention period of 14 days oxidation pond is designed. Tree plantation at 1000 Nos. / Acre is proposed around oxidation pond. Necessary approach road is proposed for 1100 Rmt. From Kumbharwada Nari road.

Part -4: Pipeline from Kumbharwada pumping station to oxidation pond:

Considering soil strata & pumping rate 450 mm dia GRP pipeline is proposed from Kumbharwada pumping station to oxidation pond. Air valve at every 500.00 Mt c/c & water hammer device with necessary valve chamber are proposed.

Part -5: Pipeline from oxidation pond to sea creek: Considering topography of cluster and surroundings there will be no problem of minimum velocity. For conveyance of effluent from oxidation pond to sea creek, 450 mm dia GRP pipeline is proposed. For final disposal RCC M150 block is also proposed. Necessary precaution to avoid

scouring, anchoring to resist strong tidal current, severe cyclone etc. are also kept in mind while designing. Final disposal point is considered in sea creek as per report of assessment of impact on marine ecology from National Institute of Oceanography (NIO). As per the report the location for final disposal is shown as geographical coordinate Lat 21°49'16.22" N and Long 72°07'33.75" E. Railway crossing is considered as per prevailing Railway authority norms.

Project Appraisal

Project approved by Industries Commissionerate & CSPO, Gandhinagar vide by letter no. IC/CSPO/ASIDE/CIA/894/335576 dated: 18.03.2010 having Amount of Rs. 973.14 Lacs. Details of which are mentioned in the table-25 given below.

Details of Project Cost

Table-25

Project Cost	Original Project Cost (Rs. In Lac)	1st Revised Cost (Rs. In Lac)	Approved Project Cost (Rs. In Lac)
RCC NP3 Pipeline Chitra cluster – Kumbharwada	156.00	177.10	288.30
Pumping M/c, Control Panel & Power Supply	8.00	10.53	58.29
Oxidation Pond, and approach road	48.00	78.53	45.88
Pipeline GRP – Kumbharwada – Oxidation Pond	114.00	117.52	206.33
Pipeline RCC – Oxidation Pond – Sea Creek	---	160.50	318.55
Sub-Total	326.00	544.18	917.36
Contingency Charges @ 5%	16.00	27.21	27.21
Consultancy Charges @ 5%	17.00	28.57	28.37
Total	359.00	599.96	973.14

Source: Project Report of CIA

5.2 Identification of stakeholders/ agencies to be involved and to evolve financial and managerial mechanisms for implementation of PPP projects.

The project implementation is sanctioned from various aids/grants available from government agencies and clearance from Indian Railway and Government of Gujarat

including GPCB. It is contemplated to complete the construction of all project components within a period of 12 months from March 2010. Services of multiple agencies are also planned to complete the project. It is approved to implement the project under ASIDE scheme through a Special Purpose Vehicle (SPV) formed by the Chitra Industries Association, which will carry out the business of developing the infrastructure facilities with participation of Bhavnagar Municipal Corporation, while operating and maintaining the infrastructure facility is to be looked after by Bhavnagar Municipal Corporation with participation of Chitra Industries Association. This arrangement will also ensure the creation of the useful assets and sustainability through an appropriate revenue generation mechanism. This project is under Assistance to State for Developing Export Infrastructure and Allied Activities (ASIDE), CETP Scheme having financial outlay as table 26.

Table – 26 : Financial outlay

ASIDE Scheme	50%
CETP Scheme	25%
BMC	15%
CIA	10%

Chapter-6

Other Infrastructural Renewal Measures

6. Other Infrastructural Renewal Measures

6.1 Green Belts

The Chitra Industrial cluster is having earmarked green space area of 1,12,000 Sq. mt., which is planned to be converted into green area by plantation in the forthcoming monsoon and in a phased manner by the CIA. Detailed map of the cluster with delineated boundaries is enclosed herewith as Fold-1.

6.2 Development of Industrial Estate(s)

Chitra industries association has planned for up-gradation of roads within GIDC, which is a part of the PPP proposal mentioned in Chapter 5.

6.3 Development/ shifting of industries located in the non- industrial areas to the existing/ new industrial estates.

At present there is no proposal for shifting of industries located in the non- industrial areas to the existing Chitra industrial estate.

Chapter-7

Specific Schemes

7. Specific Schemes

7.1 GIS-GPS system for pollution sources monitoring

At present there is no GIS-GPS system for pollution sources monitoring. This is considered as a long term measures by respective TSDF operator. There is no TSDF existing in this area, hence it is dependent on the TSDF operator.

7.2 Hydro-geological fracturing for water bodies rejuvenation

The entire region of Bhavnagar itself is a critical area in terms of groundwater quality because of the closeness to coast. However, it may be noted that the groundwater quality monitored at a station in the GIDC estate of Chitra shows a reasonable quality with respect to drinking water quality as per the IS: 10500. Moreover, it is also noteworthy that use of groundwater is strictly prohibited in the GIDC estate.

7.3 In-site remediation of sewage

The sewage treatment and disposal of the entire Bhavnagar city as well as the GIDC estate of Chitra is handled by the Bhavnagar Municipal Corporation. Bhavnagar Municipal Corporation at present is not having STP, Old STP is not functional. They are under planning to establish new STP for city sewage with 30 MLD capacities for which pre feasibility report is awaited; the same will be submitted to Government for grant.

7.4 Utilization of MSW inert by gas based brick kilns

Almost 99% of waste is collected by BMC i.e. approximately 198MT/Day. The collected MSW is disposed by Composting and pellets: 189 MT/Day (Project under implementation by M/s Hanjer Biotech Energy Private Ltd.) remaining organic waste generated from fruit and vegetable market is disposed by Organic Waste Converter supplied by Excel Crop Care Limited, Mumbai. At present waste disposed in existing land fill sites is 189 MT/Day. The site is located at village: Vadva, Nari Road, Bhavnagar, approximately 5 kms. away having area of 112 Acres with valid Authorization. The BMC has made proposal for improvement in MSW management by

purchasing two sweeper machines and 16 Temple Bell tractor-Trailer. And at present there is no proposal for utilizing inert by gas based brick kilns.

7.5 Co-processing of waste in cement industries

There are no such wastes generated in Chitra GIDC, which can be used in the cement industries, based on their calorific values.

Chapter-8

Public Awareness and Training Programmes

8. Public awareness and training programmes

It is essential to sensitize the general public about fundamental duties to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures. We will also make public aware for the following:

- Stop burning of wastes in open.
- Reduce smoke, save fuel, minimize use of vehicle and stop engine at traffic points to protect environment.
- Stop wastage of water, paper, electricity and food.

Seminars / Workshop on best practices will be organized with national level premier technical institutions / R&D organizations.

Public will also be involved by introducing of ‘whistle-blower schemes’ with incentives to identify the defaulters.

Chapter-9

Overall impact of installation/ commissioning of pollution control equipments/ measures on the CEPI score

9. Overall Impact of installation/ commissioning of pollution control equipments/ measures on the CEPI score

CEPI score is expected to reduce after implementation of the action plan framed by the GPCB in association with the concerned stake holders.

Expected CEPI Score based on Action Plan Framed by GPCB

Table-12

Sub component	Basis for sub component rating	Max	CEPI as published in CPCB documents of Dec.2009			Reduction in CEPI based on GPCB Action Plan			Justification for reduction in Score		
			Air	water	Land	Air	water	Land	Air	water	Land
A1	Based on the data on the presence of toxins	6	5.5	3	3	2	3	3	Air Only PM2.5/ PM10 identified as parameter for Air Group B with no penalty as sox and Nox not identified as Toxin.	TDS, BOD and COD are parameter has no change hence no change in score	Being a costal are TDS is boud to be there in ground water, hence no change in parameter and score
A2	Based on the scale of industrial activities	5	5	5	5	2.5	2.5	2.5	As sclc of industries is falling in the category of Moderate for all Criteria Air, Water and Land		
A	A1*A2	30	27.5	15	15	5	7.5	7.5			

Sub component	Basis for sub component rating	Max	CEPI as published in CPCB documents of Dec.2009			Reduction in CEPI based on GPCB Action Plan			Justification for reduction in Score		
			Air	water	Land	Air	water	Land	Air	water	Land
B1	Based on the pollutant concentration data(Ambient Pollutant Concentration)	8	8	7.5	7.75	4	6	6	SOx, Nox and PM are found with in limit, however PM2.5 is considered as Moderate and rest as Low (MLL) with no penalty.	TDS BOD and COD are parameter has exidance factor between 0.5 and 1.0 hence all three are as Moderate (MMM) with no penalty	Being a costal are TDS is boud to be there in ground water, However with complying norms at par it is designated as moderate for MSW and BMW also (MMM) No HW is found dumped as industries using TSDF located in other districts
B2	Based on the impacton people (Evidence * of adverse impact on people)	6	0	3	3	0	0	3	Air No reliable evidence is available hence no change	Water Conveyance of effluent through pipeline, treatment, and disposal in to sea creek through pipeline results In to no effect in vicinity.	Land Looking to the land use pattern, in surrounding this criteria is not considered for change

Sub component	Basis for sub component rating	Max	CEPI as published in CPCB documents of Dec.2009			Reduction in CEPI based on GPCB Action Plan			Justification for reduction in Score		
			Air	water	Land	Air	water	Land	Air	water	Land
B3	Based on the impact on eco-geological features(reliable evidence of adverse impact on eco-geological features)	6	0	3	3	0	3	3	No change in eco-geological feature is considered due to land use pattern- and considered as evidence of symptoms of exposure with no significant damage		
B	B1+B2+B3	20	8	13.5	13.8	4	9	12			
C1	Based on potentially affected population)	5	3	3	3	3	1	3	No reduction is considered except for water as commissioning of pipeline Conveyance of effluent through pipeline, treatment, and disposal in to sea creek through pipeline results In to no effect in vicinity. i.e. <1000		
C2	(Based on the level of exposure)	5	3	3	3	3	3	3	No reduction is considered as all monitored parameters has SNLF as 0 with low level of exposure		
C3	Based on the risk to sensitive receptors	5	0	5	5	0	0	5	No reduction is considered except for water as commissioning of pipeline Conveyance of effluent through pipeline, treatment, and disposal in to sea creek through pipeline results In to no effect in vicinity no riskto sensitive receptors		
C	(C1*C2) + C3	30	9	14	14	9	3	14			

Sub component	Basis for sub component rating	Max	CEPI as published in CPCB documents of Dec.2009			Reduction in CEPI based on GPCB Action Plan			Justification for reduction in Score		
			Air	water	Land	Air	water	Land	Air	water	Land
D	Based on the information pollution control facilities	20	10	15	15	5	0	0	There are two Large scale unit hence is considered as adequate in general for Air, Water and Land. Air- Small and Medium is considered as inadequate while common facility is not applicable for Air hence is considered as adequate. (AIA=5)	Reduction is considered for water as commissioning of pipeline Conveyance of effluent through pipeline, treatment, and disposal in to sea creek through pipeline results In to no effect in vicinity no risk to sensitive receptors. This will be adequate for all three parameters. (AAA=0)	Reduction is considered for water as commissioning of pipeline Conveyance of effluent through pipeline, treatment, and disposal in to sea creek through pipeline results In to no effect in vicinity no risk to sensitive receptors. This will be adequate for all three parameters. (AAA=0)
CEPI	A+B+C+D	100	54.5	57.5	57.8	23	19.5	33.5			
	max.CEPI		57.5			33.5					
	Aggregated CEPI		70.99			36.48			After implementation of this Action Plan for short term period the CEPI score is predicted as 36.48. As major outcome is effluent disposal and rest is the data gap which is corrected. Thus infrastructure improvement will reduce the CEPI Score.		

Chapter-10

Assessment of Techno-economical feasibility of pollution control systems in clusters of small/ medium scale industries.

10. Assessment of Techno-economical feasibility of pollution control systems in clusters of small/medium scale industries.

Looking to the nature of the industries no techno economical feasibility of the cluster is required.

Chapter-11

Efforts shall be made to encourage use of Bio-compost and Bio-Fertilizer along with the chemical fertilizer in the state to minimize the unutilized chemical fertilizer run-off into the natural water resources from agriculture fields (through Govt. policy)

11. Efforts shall be made to encourage use of Bio-compost and Bio-Fertilizer alongwith the chemical fertilizer in the state to minimize the unutilized chemical fertilizer run-off into the natural water resources from agriculture fields (through Govt. policy)

India is a country relying on agriculture for the growth of its economy the availability of the bio fertilizer in context with the use of chemical fertilizer needs to be decided in the government and highest level in the state and centre. The study area and impact area in cluster of Bhavnagar district is not affected by agriculture runoff for natural water resources.

Chapter-12

Summary of proposed action points

12. Summary of proposed action points

12.1 Short Term Action Points (up to 1 year, including continuous Activities)

Sr No	Action Points (including source & mitigation measures)	Responsible Stake Holders	Time limit	Cost	Remarks
WATER					
1. Standard flow meter at final outlet of ETP					
1	Identification of units having effluent quantity more than 25 m ³ /day.	GPCB, Concerned industries, CIA	Completed 30.06.2010	-----	To control overflowing of CIA pipeline in future, it is necessary to control the discharge of excessive quantity of wastewater from the industrial units. Identification completed
	Industrial Association will issue the circular to their member to provide the Standard flow meter.	Concerned industries, CIA	31.12.2010	3.30 lacs	It is necessary to have metering system consisting of Standard Flow Meter (MFM) at the final outlet for industries having discharge more than 25 m ³ /day. Out of identified units, four industries have already provided the flow meter and rest has procured for installation during connection to the conveyance system.
2. Identification of users dependent on water supply other than GIDC/ BMC i.e. bore well, tanker supply.					
2	Identification of source of water i.e. tanker, bore well etc. for its authenticity.	Concerned industries, CIA, GIDC, GPCB	Completed 31.08.2010	--	With a view to conserve the water, reducing wastewater generation and preventing disposal mismanagement; it is necessary to restrict water consumption from sources other than regular supply of GIDC/ BMC. Units are entirely dependent on GIDC/BMC supply and purchasing water only in case of short supply.
	Direction to restrict the use of sources that are not permitted like; bore well and tankers	Concerned industries, CIA, GIDC, GPCB	Completed 31.08.2010	--	
3. Collection and conveyance of effluent in to environmentally safe manner					
3	All industries are required to be covered	Concerned industries,	31.12.2010	--	Earlier effluent was discharged through underground drainage and surface drain having operational problems as well,

	effluent conveyance, treatment and disposal scheme	BMC			which is ultimate disposal in to creek. All units have become of ongoing scheme.
	Zero industrial discharge unit should not be given connection for discharge of industrial effluent	Concerned industries, CIA, GIDC, BMC	31.12.2010	--	Presently due to ongoing work of conveyance, treatment and disposal scheme, effluent is being diverted through surface drain having ultimate disposal in to creek. It will be ensured while releasing connections for effluent disposal.
	All industrial units shall be directed to operate only one outlet through flow meter for effluent disposal so that unauthorized discharge can be checked	Concerned industries, CIA, GIDC, BMC	31.12.2010	--	It will be ensured while releasing connections for effluent disposal.
4. Identification of unauthorized connection to CIA drainage line OR BMC					
4	Intensive monitoring needs to be carried out and verification needs to be done frequently.	CIA, GIDC, BMC, GPCB	Ongoing process after commissioning of pipeline.	--	Unauthorized connection in drainage line to be checked and disconnected.
5. Sampling point should be easily approachable to enable regulatory authority for drawing sample of discharge effluent.					
5	All industries are required to provide appropriate sampling chamber/point in the frontal premises of the industries before connecting to the underground drainage under implementation.	Individual industries, CIA, GPCB	31.12.2010	--	To have better environment monitoring system in place it is necessary to have proper effluent sampling system. It will be ensured while releasing connections for effluent disposal.
6. Monitoring of quality of effluent at outlets and point of confluences					
6	Identification of sampling points	GPCB, CIA	Completed	--	To check the effectiveness of pollutants released in to the environment it is necessary to have proper monitoring mechanism in place. Sampling points already identified.

	After mixing with city sewage Final outlet of system at disposal point				
	Initiating sampling once in a month from identified locations.	GPCB	Completed		Sampling at identified location is initiated from June-2010.
Completion of effluent conveyance, treatment and disposal system in time frame.					
7	Conveyance from estate to Oxidation pond.	CIA	Completed	9.73 crore total	Earlier this effluent was discharged through underground drainage and surface drain having ultimate disposal
	Commissioning of Treatment Plant – Oxidation Pond	CIA	Completed Ready for commissioning		
	Disposal system from Oxidation pond to final out fall as approved by NIO. Flow meter with totalizer at outlet of oxidation pond.	CIA	Completed		Presently due to ongoing work of conveyance, treatment and disposal scheme, it is diverted through surface drain having ultimate disposal in to creek.
	Provision of electrical energy meter to measure power consumption.	CIA, GIDC, BMC	Completed 31-12-2010		There is an inherent provision in scheme under implementation.
	Commissioning of Entire Scheme	CIA, GIDC, BMC	31-12-2010		
AIR					
Upgrading of Air Pollution Control Measures (APCM)					
1	Upgrade air pollution control system by installing/ modifying suitable APCM like Cyclone, Multi-cyclone, bag filters etc.	Concerned industries CIA, GPCB (For identification of suitable APCM help	31.12.2010. (submission of action plan by industry) 30.09.2011 (in to implementa	81.94 lac (15.37 lac - Bentonite unit)	The industries either chemical industries with no chemical process emission having utility installation other than SIB, thermic fluid heaters etc. has major concern for PM, SOx and NOx as pollutant from flue gases.

		of GCPC and other experts can be sought based on need by the industry)	tion)		Bentonite based mineral processing industries has process emission from grading and grinding operations. PM is concern parameter from process emission, Above both needs to meet with revised AAQM norms particularly for PM 2.5, and PM10.
Adoption of cleaner fuel and cleaner technology					
2	Mineral processing (Bentonite) industrial units required adopting cleaner technology and process wherever it is feasible considering availability and economics.	Concerned industries, GPCB (Help of GCPC and other experts can be sought based on need by the industry)	31.12.2010 (submission of action plan by industry) 30.09.2011 (in to implementation)		Mineral processing (Bentonite) industrial units required adopting cleaner technology and process. All units have submitted undertaking to upgrade, modify and install APCM as per action point.
<p>Action plan of Bentonite Industry</p> <p>Industries have submitted undertaking to take following measures for control of Air Pollution by 31st December 2010</p> <ol style="list-style-type: none"> 1. Ramp shall be constructed at the place of unloading from truck which shall be fixed/ Movable in nature to minimize dropping height which will avoid dusting during unloading. 2. Raw material pit shall be covered to avoid dusting during lifting through bucket elevator. 3. Raw material silo shall be covered and provided with air vent and dust collector to avoid dusting during raw material storage. 4. Raw material vibratory screen shall be kept in close cover and provided with air vent and dust collector to avoid dusting during screening. 5. Inlet at product vibratory screen shall be widened and kept at a position with minimum dropping height and reduced slope. 6. They shall use only authorized fuel as per consent. 7. Stack attached to kiln shall be provided with dust collection system like cyclone, bag filters, 					

	dust collection chamber etc.				
	8. Dust collected during manufacturing and operation of Air Pollution Control System shall be stored in bags.				
Plantation in the industrial estate					
3	Area to be earmarked for the plantation in consultation with GIDC	CIA, GIDC	Completed 30.09.2010		Concerned authority shall be asked to provide adequate green belt in the periphery as well as wherever possible within the GIDC. 120,000 M2 area is already earmarked Indicted on enclosed map.
	Preparation of three years plan considering the present plantation as baseline datum	CIA, GIDC (In consultation with Forest department)	30.12.2010	10 lac	Plantation will start after completion of the road work.
Control of fugitive emission					
4	Monitoring the area in addition to the progress of Conveyance system followed by Paved road and Plantation	CIA, GPCB	Ongoing task till completion of the work		Construction of paved road and maintaining Ambient Air Quality during construction phase are the major source of fugitive emission.
Ambient Air Quality Monitoring					
5	Sampling from ambient air quality monitoring station (newly established) for SPM, PM, SOx, NOx and PM 2.5 in particular (Monthly).	GPCB	Completed		Operating the existing AAQMS regularly and also to increase the number of stations. SPM, PM, SOx, NOx is started for additional station on July 2010 and PM2.5 commissioned from June 2010 on monthly basis.
HAZARDOUS WASTE					
Checking of illegal transportation and dumping of Hazardous waste					
1	Constant vigilance require to be kept on illegal:	Individual industries, TSDF	This is not persistent in the Chitra due to		Illegal dumping of hazardous waste posing problem of surface and ground water pollution.

	<ul style="list-style-type: none"> • Transportation • Dumping 	operator, CIA, GPCB (Help from RTO can be taken for transportation issue)	inorganic industries in the majority, However, it is on going process.		This is not persistent in the Chitra due to inorganic industries in the majority,
Adoption of 4- R's (Reduce, Recover, Reuse, Recycle)					
2	Inventorying of the various solid/ Hazardous waste generated from the industries	GPCB, Concern industries, CIA, GCPC	31.12.2010		It is required to adopt 4-R's (Reduce, Recover, Reuse, Recycle) for better management of Hazardous waste.
	Organizing series of workshop and seminars.	GPCB, Concern industries, CIA In consultation with GCPC/ NPC/ NCPC	31.12.2010		Industrial units need to be trained towards cleaner fuel and cleaner technology for cleaner production.

Compliance Of Suggestion/Comments Of Steering Committee Chitra Bhavnagar : Short Term Action Points

Sr No	Action Points (including source & mitigation measures)	Remark
1.	Time bound action plan for adaption of cleaner fuel and cleaner technology in Mineral Processing(Bentonite) industrial units should be submitted to GPCB by 31 st December,2010 and its implementation should be ensured by 30 th September,2011	Included in the updated action plan. Short Term Air Action point no.2
2.	Gujarat Pollution Control Board should also	Included in the updated action plan. Short Term Air Action point no.4

	be involved as implementation agency for control of fugitive emissions by keeping a vigil on the concerned industries.	
3.	CEPI should be evaluated for the same criteria pollutants considered by CPCB and various indices should be considered as per the standard guidelines mentioned in CPCB documents.	Included in the updated action plan. Chapter no.9
4.	CEPI should be evaluated on the basis of real time data after implementation of short term and long term action plans.	It will be included in chapter no.9
5.	Demographic details and water drainage pattern and road networks in 2 km buffer zone should be incorporated.	Included in the updated action plan. Chapter no.1
6.	Sector-wise and industry-wise action points should be incorporated.	Included in the updated action plan. Chapter no.2.6.2
7.	Odour problem resulting from VOC should be addressed alongwith capacity of SPCB for VOC monitoring.	Not applicable to Chtra Cluster
8.	Managerial and financial plans should be incorporated.	It is already incorporated in the updated Action Plan.In chapter no.3.6.6
9.	DG sets should be provided at all pumping stations/ETPs/STPs to avoid overflow of untreated effluent during power failures in all clusters.	DG set will be provided at the pumping stations of the common pipeline.

12.2 Long Term Action Points (more than 1 year)

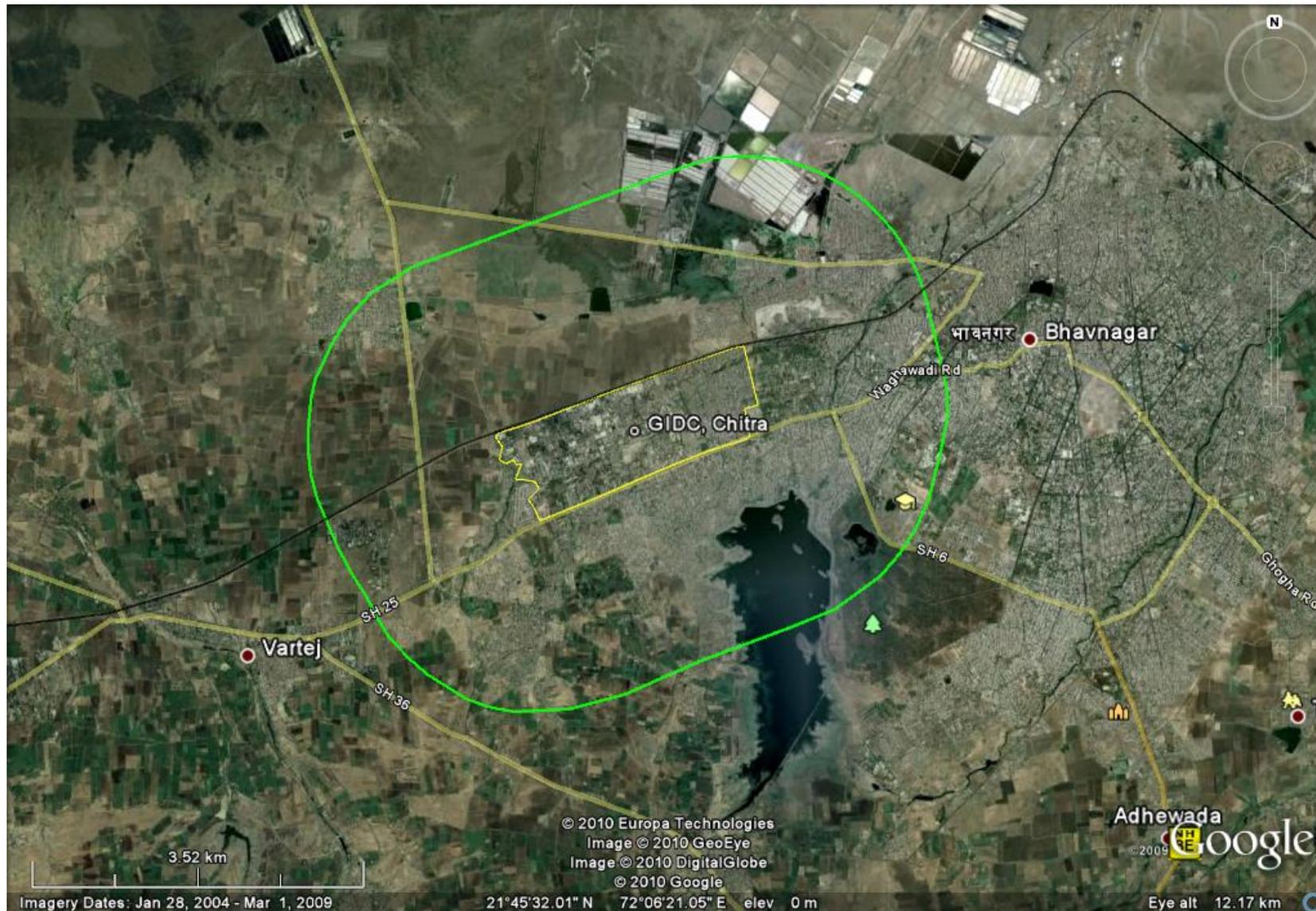
Sr No	Action Points (including source & mitigation measures)	Responsible Stake Holders	Time limit	Cost	Remarks
1	Intensive monitoring needs to be carried out and verification needs to be done frequently.	CIA, GIDC, BMC, GPCB	Ongoing process after commissioning of pipeline.		Unauthorized connection in drainage line to be checked and disconnected.
2	Monitoring the area in addition to the progress of Conveyance system followed by Paved road and Plantation	CIA,GIDC , BMC	Ongoing task till completion of the work		Construction of paved road and maintaining Ambient Air Quality during construction phase are the major source of fugitive emission.

Compliance Of Suggestion/Comments Of Steering Committee Chitra Bhavnagar : Long Term Action Points

Sr No	Action Points (including source & mitigation measures)	Remark
1.	Detailed health impact study should be carried out through a reputed agency.	Included in the updated action plan. Long Term Action point no.3
2.	CEPI should be evaluated for the same criteria pollutants considered by CPCB and various indices should be considered as per the standard guidelines mentioned in CPCB documents.	Included in the updated action plan. Chapter no.9
3.	CEPI should be evaluated on the basis of real time data after implementation of short term and long term action plans.	It will be included in chapter no.9

4.	GPS based tracking system for transport of hazardous waste should be incorporated.	It is already incorporated in the updated Action Plan.In chapter no.7.1
5.	Online monitoring system linked with regional office and head office should be included in the plan.	NA
6.	Resource management plan/future development/managerial plan for new sitting of industries should also be incorporated.	-
7.	Quantification of pollutants needs to be done including solvent consumption of industries.	-
8.	Possibility of co-processing of hazardous wastes may be explored and the same may be incorporated.	NA

Annexure-I: Map showing GIDC Industrial Estate and the 2km buffer region



Annexure-2: Ground Water Quality At Chitra Estate

Period	ALK	BOD	CHL	COD	Colour	Condtvty	DOX	FLU	NH3	NIT	NTR	pH	PHO	SUL	T.H	TDS	TKN
Mar-10	320	2.1	190	9	C.Less	1620	3.1	0.48	0.56	0.108	0.164	7.63	0.116	88	430	790	1.4
Feb-10	310	1.8	170	10	C.Less	1590	3.5	0.42	0.56	0.082	0.144	7.70	0.126	76	410	674	1.12
Jan-10	290	1.9	120	9	C.Less	1600	3.9	0.39	0.84	0.082	0.186	7.78	0.148	58	400	712	1.4
Dec-09	300	2.1	270	9	C.Less	1610	4	0.4	0.28	0.076	0.176	7.91	0.096	58	420	810	0.84
Nov-09	260	1.5	240	10	C.Less	1490	3.6	0.41	0.84	0.137	0.310	7.51	0.096	68	350	860	1.12
Oct-09	240	1.6	290	10	C.Less	1560	3.9	0.43	0.28	0.112	0.237	7.43	0.096	71	360	830	NAH
Sep-09	260	1.2	330	8	C.less	1330	4.3	0.38	0.56	0.088	0.186	7.78	0.124	72	320	810	0
Aug-09	280	1.4	380	10	cless	1600	4	0.4	0.84	0.082	0.176	7.88	0.164	80	340	890	1.12
Jul-09	270	1.2	300	10	C.less	1530	3.6	0.39	0.28	0.076	0.186	7.67	0.148	68	340	810	1.12
Jun-09	410	1.1	360	10	C.less	1344	3.8	0.47	0.56	0.071	0.188	7.65	0.088	72	550	880	0.84
May-09	390	0.8	310	9	nil	1120	3.6	0.43	0.28	0.042	0.109	7.71	0.034	64	510	840	0.84
Apr-09	380	0.9	200	9	nil	1100	4.1	0.44	0.56	0.032	0.110	7.44	0.053	78	480	620	1.12
Mar-09	550	1.4	220	19	nil	1100	3.8	0.48	0.28	0.054	1.720	7.66	0.120	45	380	640	1.12
Feb-09	500	1.2	180	10	P.Nil	810	4.6	0.43	0.56	0.030	1.360	7.76	0.100	62	500	470	1.12
Jan-09	520	1.8	180	6	Nil	910	4.9	0.37	0.56	0.027	1.480	7.80	0.100	74	360	560	0.84
Dec-08	430	1.86	220	6	5	1730	3.9	0.65	0.28	0.049	0.520	7.76	0.024	48	330	660	2.24
Nov-08	300	2.25	210	7	Nil	1320	3.9	0.53	0.28	0.018	1.200	7.53	0.022	49	320	640	0.56
Minumum Value	240	0.8	120	6		810	3.1	0.37	0.28	0.018	0.109	7.43	0.022	45	320	470	0.00
Maximum Value	550	2.3	380	19		1730	4.9	0.65	0.84	0.137	1.720	7.91	0.164	88	550	890	2.24
Average Value	354	1.5	245	9		1374	3.9	0.44	0.49	0.069	0.497	7.68	0.097	67	400	735	1.05
Permissible Values as per IS: 10500	600	NS	1000	NS	25	NS	NS	1.5	NS	NS	100	8	NS	400	600	2000	NS
Desirable Values as per IS: 10500	200	NS	250	NS	5	NS	NS	1	NS	NS	45	6.5-8.5	NS	200	300	500	NS

Bore well water sample of GIDC Chitra from plot no 290, Das Pendawala Foods P Ltd

Annexure - 3
Compliance of Suggestions /comments of steering committee

Sr. No.	Suggestions /comments of steering committee	Compliance
1.	Need for demarcation of Geographical boundaries and the impact zones in a digitized map.	Map already obtained and included. As included in Annexure.
2.	Long term and short term plans along with sector and region-wise action points have to be defined clearly with time line, cost and responsible implementing agencies/ stakeholders.	Action Plan is updated accordingly. As included in Chapter no. 12 Action Point no.12.1 and 12.2 for short term and long term respectively.
3.	Major industry-based action plans should be prepared so that the problems of individual units could be identified and action points (long term and short term) be implemented within stipulated time-frame.	There are two major industrial categories. Chemical industries having water pollution and bentonite based mineral industries having air pollution potential. Both have submitted action plans. As included in Chapter no. 12 Action Point no.1 for chemical industries and As included in Chapter no. 12 Action Point no.2 for bentonite industries.
4.	Functioning of CETP/FETP/EPL/PETL in Ankleshwar should be reviewed and design should be re-checked on the basis of COD load, carbonaceous BOD, refractive COD through performance study.	NA
5.	Appropriate action points should be incorporated in action plan to control flow of sewage in Amla Khadi and Chhapre Khadi in Ankleshwar.	NA
6.	Groundwater quality should be	Ground water monitoring is being regularly

	assessed properly and taken into consideration and remedial measures should be incorporated for the improvement in groundwater quality.	carried out. As included in Chapter no. 4 Action Point no.4.2.3
7.	Quantification of pollution from non-point sources should be done and baseline data of VOC should be collected.	As included in Chapter no. 12 Action Point no.6 of General Compliance included at Short Term Action Points.
8.	Short-term and long term awareness programme should be incorporated.	This is regular activity. Recently two meetings organized.
9.	Online monitoring system linked with regional office and head office at-least at two stations (Ankleshwar and Panoli) should be included in plan.	NA
10.	Scheme of plantation with clear defined policy should be incorporated to control odour problem in Ankleshwar.	NA
11.	GPS based transportation and tracking system for hazardous waste should be ensured.	As included in Chapter no. 12 Action Point no.8 of General Compliance included at Short Term Action Points.
12.	Action plans should clearly be defined with short term and long term actions including technological improvement in small scale sector and budgetary requirement for various works.	As included in Chapter no. 12 Action Point no.7 of General Compliance included at Short Term Action Points.
13.	DG sets should be provided at all pumping stations/ETPs/STPs to avoid overflow of untreated effluent during power failure in all clusters.	As included in Chapter no. 12 Action Point no.12 of General Compliance included at Short Term Action Points.
14.	Efforts should be made for	It is continuous process and same is under

	technological intervention (Green/clean technology) in all the industrial clusters where SSI's using old technology exist in cluster.	implementation stage.
15.	Efforts should be made for complete utilization / recycling of treated effluent in the industries and discharge in deep sea should be avoided for resource conservation.	Industrial effluent is conveyed, treated and disposed as per NIO study.
16.	Industrial and domestic waste should be treated separately.	Industrial effluent is conveyed, treated and disposed as per NIO study.
17.	Action points for proper functioning of TSDF/CETP and FETP should be prepared.	NA
18.	Sectoral/regional/micro level plans for reduction/reuse/recycling of wastewater /awareness and control of fugitive emission for non-point sources should be prepared.	As included in Chapter no. 12 Action Point no.2 of Air included at Short Term Action Plan 12.1.
19.	Action points for Groundwater management/VOC/HAPS control /noise pollution control should be incorporated in plan.	This has already been included under various action points of the Action Plan.
20.	Resource management plan/future development/managerial plan for new sitting of industries should also be incorporated.	-
21.	Quantification of pollutants needs to be done including solvent consumption of industries.	-
22.	Health Impact Assessment Study to be undertaken.	As included in Chapter no. 12 Action Point no.3 included at General Complainece of

		Short Term Action Plan.
23.	Plan of Green Belt development to be incorporated.	As included in Chapter no. 6 Action Point no.6.1
24.	Impact on CEPI score after implementation of short term and Long term Action points should be estimated.	Estimated and presented in chapter - 9 of the Action Plan.
25.	Review of locations of existing Air, Water and Ground water monitoring stations and need of new stations with regard to density of Industries.	As included in Chapter no. 2 Action Point no.2.6.1 for water, as included in Chapter no. 3 Action Point no.3.1.1 for Air and as included in Chapter no. 4 Action Point no.4.2.3 for G.W.
26.	Monitoring of all STPs and CETPs must be conducted regularly and should be recorded.	NA
27.	Plan for Municipal Solid Waste, plastic waste, Bio-medical and Hazardous Waste quantification and management. Present status need to be mentioned.	This has already been covered under action plan. As included in Chapter no. 4 Action Point no.4.3
28.	GPS based continuous transportation and tracking system for hazardous waste in Ankleshwar.	NA
29.	The plastic waste management in Vapi through co-processing in Cement Kiln would be more environment friendly rather than its conversion into Diesel to avoid sludge disposal problem.	NA
30.	Vehicular pollution and Traffic management should be addressed in the action plan.	This is already covered under the Air Action plan. As included in Chapter no. 3 Action Point no.3.2

31.	Magnetic flow meters/ electric meters with recorders should be used for flow measurements.	Included at Action Point no. 1 of Short Term Action Plan of Water.
32.	Action for reducing consumption of fresh water by the industries as per CREP recommendations based on consumption per unit production.	There are no CREP industries in the cluster.
33.	Action regarding capacity building of SPCB to ensure proper monitoring and compliance of action points.	-
34.	Adoption of Principles of reduces, reuse, recycle & recover in action plan.	Included at Action Point no. 2 of Short Term Action Plan of Hazardous Waste of chapter no 12.