VISAKHAPATNAM

FINAL ACTION PLAN

FOR IMPROVEMENT OF

ENVIRONMENTAL PARAMETERS

IN

CRITICALLY POLLUTED AREAS

"VISAKHAPATNAM CLUSTER"

ANDHRA PRADESH

NOVEMBER 2010

A.P. POLLUTION CONTROL BOARD

PARYAVARAN BHAVAN, A-3, IE, SANATHNAGAR, HYDERABAD

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PREFACE

CPCB has evolved a Comprehensive Environmental Pollution Index (CEPI) for 88 study areas with an objective of identifying polluted clusters or areas in order to take concerted action and to centrally monitor them at the national level to improve the current status of their environmental components such as air and water quality, ecological damage and visual environmental conditions. As per the study of CPCB, Visakhapatnam area was considered as critically polluted area.

The Steering Committee of CPCB, New Delhi on CEPI reviewed the draft Action Plan of **Visakhapatnam cluster** of Andhra Pradesh State on July, 2010 and gave certain suggestions / comments. Taking into consideration the suggestions / comments made by the steering committee, a revised action plan was prepared by APPCB and submitted to the CPCB.

The MoE&F reviewed the APPCB action plans for Visakhapatnam Areas and continued in the list of the Critically Polluted Areas vide MoE&F Notification Dated 26th October 2010.

The Central Pollution Control Board's In-House Committee reviewed the revised Action Plans of the A.P. Pollution Control Board on 02.11.2010 for Visakhapatnam Clusters in the light of the suggestions made by the Steering Committee in October, 2010 and also on the earlier observations / suggestions made by the In-House Committee. The meeting was attended by the Board's Officials. During the meeting the In-House committee observed that some of the suggestions of the Steering Committee have been incorporated in the Action Plans. However, it has sought the Final Action plans for the cluster areas.

Accordingly, APPCB has prepared the Final Action Plan on Critically Polluted Area of **Visakhapatnam cluster** taking into consideration the suggestions made by the In-House committee and the same is submitted to the Central Pollution Control Board, New Delhi for Consideration.

INDEX

ACTION PLAN FOR VISAKHAPATNAM BOWL AREA

1. Introduction:

Visakhapatnam is situated in North Eastern Coast of Andhra Pradesh with a topography like a spoon shaped basin surrounded by hill ranges on three sides and sea on the other side and is often called as bowl area for assessment of environmental related issues. The hill ranges cause inversion conditions particularly in winter season.

Visakhapatnam attracted for establishment of major industries like M/s. Hindustan Petroleum Corporation Ltd., (Formerly M/s. CALTEX – Refinery), M/s. Hindustan Zinc Ltd., (Zinc & Lead Smelter), M/s. Coromandel Fertilisers Ltd., (Complex Fertiliser Plant) etc., due to close proximity to a natural harbour and sea port.

With the establishment of major industries in the core area of Visakhapatnam and few more industrial establishments like M/s. Hindustan Polymers Ltd., (a distillery), M/s. Andhra Cements Ltd., (a cement plant), M/s. Visakha Co-operative Dairy (a milk dairy) in the sub-urban areas, the water and air pollution problems aggravated and hence the city occupied place in the map of pollution potential areas. Major habitations and industries are co-existing in the bowl area (habitation developed on surroundings of all major industries).

1.1 Background:

Visakhapatnam is one of the identified problematic areas in the country due to its vast industrial activities with available harbour facilities and other infrastructure. At the 29th conference of the Chairmen and Member Secretaries of the Central and State Pollution Control Boards held at Srinagar, 12 areas were identified as problematic areas in which Visakhapatnam is one of them. As per the directions of the MoEF, New Delhi, the CPCB identified the bowl area of Visakhapatnam in Andhra Pradesh one among the critically polluted areas of the country in April 1989.

The issues considered for declaring Visakhapatnam as critically polluted area are:

- Ambient Air Quality reached to critical level in respect of SPM, SO2 and NOx.
- Industries contributing significant pollution load in terms of BOD are Hindustan Polymers and Municipal Waste, while ammonical nitrogen and fluoride are being contributed by M/s.Coromandel Fertilizes Ltd.
- High concentration of fluoride, nitrate and zinc in the ground water were found.

- There was no systematic and proper disposal of solid waste generated from Hindustan Zinc Ltd.,

A team from the CPCB visited Visakhapatnam along with their mobile laboratory during December 1989 and conducted survey both on water and air pollution. Based on the study, a status report on "Assessment of the status of Ambient Air and Environmental water quality and pollution generation in Visakhapatnam" had been prepared.

During the review meeting of the conference of Chairman, Central & State Boards with MoEF, GoI at New Delhi on 14.05.1990, it was decided to make Visakhapatnam free from pollution by end of August 1991 and a special drive shall be made on all fronts such as water pollution, air pollution, soil pollution, noise pollution and other smell causing problems etc., in the city and an action plan had to be prepared. The APPCB was directed to submit a monthly report to the CPCB & MoEF on the progress in this regard. An action plan covering water pollution, air pollution, noise pollution, automobile pollution and hazardous waste management in the Visakhapatnam city was prepared in 1990.

In consultation with CPCB, the Member Secretary of APPCB submitted a time targeted action plan and communicated to all the following identified polluting industries during August 1990 and target dates were fixed.

1) M/s.Coromandel Fertilizers Ltd,
2) M/s.Hindustan Petroleum Corporation Ltd, (Refinery)
3) M/s.Hindustan Zinc Ltd,
4) M/s.LG Polymers (Initially M/s.Hindustan Polymers Ltd),
5) M/s.Andhra Cements Ltd, (initially M/s.Visakha Cements)
6) M/s.Visakha Co-op Dairy,
7) M/s.Visakhapatnam Steel Plant
8) M/s. Visakhapatnam Port Trust
9) M/s.Pragathi Fertilizers (closed)
10) M/s.Coastal chemicals (closed)
11) M/s.Steel Create (closed)
12) M/s.A.K. Corporation (name changed as M/s.A.K.C. Steels Ltd and it is only steel re-rolling mill)
13) M/s.Andhra Steel Corporation (closed)
14) M/s.Granite stone crushers (closed)

The A.P. Govt. vide order dt.30.04.1991 constituted an Expert committee to look in to the increasing problems of pollution in Visakhapatnam and to suggest appropriate measures for controlling the pollution with the following members:

1. Prof. V. Sundaresan, Ex. Director, NEERI.
2. Prof. C.A. Sastry, IIT, Madras.
3. Prof. T. Sivaji Rao,
4. Sri. Gurunadha Rao, Local MLA
5. Chief Town Planner, VUDA
6. Regional Officer, Pollution Control Board, Visakhapatnam, Convener.

Besides this a District Review Committee under the chairmanship of District Collector for reviewing the pollution problems in the District had been formed. Another committee (watch dog committee) under the chairmanship of Naval Chief for conducting frequent meetings and highlighting the pollution problems was also constituted.

The Expert Committee visited Visakhapatnam in the month of August 1991 and February 1992 and after discussions with various organizations, industries and District Officials recommended the following issues to the state government as well as to the industries.

- The land use classification prepared by Visakhapatnam Urban Development Authority (VUDA) should be critically reviewed with respect to ground truth as there is a mismatch between plans and ground conditions shown in VUDA Master Plan.
- Visakhapatnam Municipal Corporation (VMC) should be asked to provide an effective sewerage system to collect sewage from residential and commercial areas and provide effective STP to reduce water pollution in harbour area. The VMC should prepare a plan for solid wastes Disposal system and approach the Government of India for funding.
- Villages viz., Mulagada and Chukkavanipalem adjoining the M/s.Hindustan Zinc Ltd, should be relocated and rehabilitated in order to prevent continuous exposure of lead and zinc by the public which is likely to be emitted even after effecting all control measures. There are other equally hazardous industries such as M/s.Hindustan Petroleum Corporation Ltd, M/s.Coromandel Fertilizers Ltd, etc., which will have combined effect on the health and well being of the local population, particularly the weaker sections.

- The Naval Establishment has constructed multi storied buildings in industrial area completely violating the local building bye-laws and exposing resident population directly to Air Pollution. Hence, no more residential buildings in that zone should be permitted.
- A comprehensive Regional E.I.A should be taken up immediately to encompass greater Visakhapatnam area, for which all the industrial establishments should contribute on a pro-rata basis.
- The land use classification prepared by VUDA has been violated in several locations. Hence, the VUDA master plan should be implemented strictly and no further violations should be allowed with respect to land use classification.
- M/s.VPT owns large track of land, which may attract further industrial activity. In future no polluting industry should be located in the area under the ownership of the port.
- M/s.VPT should prepare a Master Plan from Environmental angle before any further decisions are made to locate industries or commercial activities and get it approved by Ministry of Environment, Government of India.
- A rational network of Air Quality Monitoring Stations along with Micro Meteorological Stations is an urgent need. A minimum number of 15 monitoring stations will be required to cover Visakhapatnam. M/s. Visakhapatnam Steel Plant and other large industrial units such as NTPC which are coming up outside the bowl area will need additional stations.
- A.P. Pollutions Control Board should purchase the Mobile Van along with the laboratory in addition to permanent stations in Visakhapatnam area to participate in the Monitoring Programs.
- No further polluting industry should be located in Visakhapatnam Bowl Area. In case additional industries are forth coming, the Andhra Pradesh Government should create and identify locations 15 Kms, outside the boundary bowl area.
- The large influx of mobile population into Visakhapatnam city area brings about environmental sanitation problems as well as acute housing shortages. In order to minimize pollution, adequate sanitation facilities for the floating population, community toilets should be provided in a greater number of areas adjoining Railway Stations, Bus Station, Commercial Complexes, Markets as well as slum areas.

1.2 Status of major polluting Industries during 1992:

1.2.1 M/s. Hindustan Petroleum Corporation Ltd

- In 1992 the refinery was not having sulphur recovery unit when the crude through put was 4.5 MMTPA.
- The unit was not having ETPs for treatment of the effluents.
- The industry was having major problem on disposal of high oily sludges and other solid wastes.
- The unit was having odour problems from CDU-I & II due to hot well off gases.

1.2.2 M/s.Coromandel Fertilizers Ltd.,

- CFL established an integrated fertilizer complex in the year 1964 originality with all facilities to manufacture intermediate products.. The industry uses Sulfur, Urea, Rock Phosphate, Ammonia etc., with related raw materials and intermediates. All the required intermediate products such as Ammonia, Urea, Sulfuric acid and phosphoric acid were manufactured captively by M/s. CFL.
- The industry used to cause lot of SO2 emissions during startups from 1400 TPD Sulphuric acid plant.
- The industry was utilizing huge quantities of sea water for sluicing of Gypsum for wet disposal and there by storing gypsum in 100 acres without lining and causing of ground water contamination due to leachate from gypsum storage.
- The industry used to store raw materials openly.

1.2.3 M/s.Hindustan Polymers (name changes as LG Polymers)

- Initially the industry was used to produce ethyl alcohol (distillery), polystyrene, styrene, expandable polystyrene, toluene using molasses and benzene. Air and water pollution problems were there at that time.

1.2.4 M/s.Rain Calcining Ltd, (name changed as Rain Carbon India Ltd)

- Industry is involved in producing calcining petroleum coke (kiln-1 no) with a waste heat recovery boiler (1 no) and was having Coal Fired Boiler to produce power as a by product. The main air pollution sources were SPM & SO2.
- The industry initially was not having dust suppression system and used to cause fugitive emissions from coke pad areas.

1.2.5 M/s.Hygrade pellets Ltd, (name changed as Essar Steels Ltd)

- The Industry established initially to produce iron ore pellets and the main raw material required i.e. iron ore fines were being stored in

the premises and in the port area and thereby used to cause lot of fugitive emissions.

- The industry was generating ion ore fines slurry and used to store in slurry ponds in 10 acres and there were lot of emissions.
- The industry provided only multi cyclones to the indurating furnaces-2 nos to control SPM emissions.
- The industry initially was not having dust suppression system from raw material storage areas.
- The industry was not having closed conveyors for finished product conveyor belt.
- The industry used to cause lot of emissions during power shut downs and due to process disturbances.

1.2.6 M/s.Visakhapatnam Port Trust

- By 1992 M/s.VPT used to handle 15-20 MMTPA and there was no dust suppression system.
- The port was storing some of the dusty cargoes very nearer to the habitations.

1.2.7 M/s.Hindustan Zinc Ltd,

- Initially the industry was having lead plant and was not meeting the Board standards for the effluents from lead plant.
- The industry was not having de-dusting system to the zinc oxide plant was not having tail gas treatment plant to the sulphuric plant.
- There was no systematic and proper disposal of solid waste generated from the industry.

All the above industries have upgraded their pollution control systems from time to time and the existing pollution control systems in the major industries have been given under Action Plan (para 3.0)

1.3 Status of Air jQuality in Visakhapatnam between 1990 – 2009 :

1.3.1 National Environmental Engineering Research Institute (NEERI) carried out air quality studies in Visakhapatnam and the values are given below:

1990 (Winter) – SPM – 117 to 394 ug/M3, SO2 – 6 to 230 ug/M3, NOX – 9 to 18 ug/M3.

1990 (Summer) – SPM – 36 to 326 ug/M3, SO2 – 3 to 45 ug/M3, NOx – 3 to 20 ug/M3 (24 Hourly Average)

2002 (Winter) – SPM – 127.5 to 302.6 ug/M3, SO_2 – 6.6 to 44.8 ug/M3, NOx – 5.2 to 15.0 ug/M3

2002 (Summer) – 121.7 to 265.6 ug/M3, SO2 – 9.2 to 46.5 ug/M3, NOx – 4.4 to 14.3 ug/M3.

1.3.2 APPCB has been monitoring air quality for the parameters of RSPM, TSPM, SO_2 and NOx on regular basis at nine locations, out of which three locations are in the Old Town area.

- The annual averages AAQ values from the year 2000 - 2009 are given at **Annexure-I.**. The values reported indicate that except TSPM, no abnormal values are observed.

1.3.3 APPCB has been reviewing all the industries existing in bowl area from time to time and various directions have been issued for the upgradation of the pollution control systems.
As per the directions of CPCB vide Letter dt.23.02.2006, a Committee has been constituted to review the critically polluted area and exclusive reviews were conducted on 10.11.2006, 19.04.2007, 15.05.2008, 16.10.2008, 16.12.2008, 06.11.2009 and 25.02.2010.

2. Comprehensive Environmental Pollution Index (CEPI):

CPCB has evolved a Comprehensive Environmental Pollution Index (CEPI) for 88 study areas with an objective of identifying polluted clusters or areas in order to take concerted action and to centrally monitor them at the national level to improve the current status of their environmental components such as air and water quality, ecological damage and visual environmental conditions. Visakhapatnam is in the 40th place as far as CEPI score is concerned with a score of 70.82. It has been suggested that areas having aggregated CEPI of 70 and should be considered as critically polluted areas. Accordingly, Visakhapatnam is considered as a critically polluted area as per the CEPI score also. However, the sub-indices for air, water and land for Visakhapatnam are 57.0, 57.05 and 55 only. However, keeping the overall CEPI in view, an action plan has been prepared for Visakhapatnam in order to put further efforts by various sectors including industrial sector for pollution control (para 3.0).

2.1 Remarks of APPCB on CEPI:

The data considered and the study period preferred have not been indicated in the CEPI report. The geographical area of the study area has not been mentioned. However, the bowl area of Visakhapatnam has been declared as critically polluted area by MoEF's Office memorandum dated 15.03.2010. Certain pockets of Visakhapatnam especially towards sea coast / creeks were marshy lands and after reclamation, the industries were established, hence in assessing the ground water characteristics it is not clear whether this parameter has been considered.

Visakhapatnam is likely to attract maximum factor under A2 due to scale of industrial activities which cannot be changed further. it is also likely to attract maximum factor under C1 due to number of people residing within 2 KM radius from the industries are more than 1,00,000, hence, no possibility for change in C1. Similarly, maximum factors are possible under C3 also (C3=0 if 'no' and 5 if 'yes' – additional risk to sensitive receptors within 2 KM distance from the source).

CEPI for air environment of Visakhapatnam is 57.0 with the break up of A+B+C+D as 15+12+20+10, for water environment as 57.7 with the break up of 15+12.5+20+10, for land environment as 55.0 with break up of 15+12+18+10. It indicates that in all environments maximum values is shown under score 'C'. Hence, this needs to be examined thoroughly.
In the above circumstances, it may be noted that the action plan would address the contribution of pollution due to air, water, hazardous waste, solid waste and bio medical waste, sewage pollution, vehicular pollution etc., to the overall CEPI.

2.2 A map indicating the bowl area which is declared as critically polluted area is annexed at **Annexure-II**

3.0 Action plan for improvement of Environmental parameters in bowl area of Visakhapatnam:

A draft action plan was prepared initially by APPCB for all sectors including industry sector based on the directions issued by APPCB from time to time. The industries existing in bowl area have been reviewed at Member Secretary level and certain directions have been issued. A stakeholders meeting with industries, Municipal Corporation, Visakhapatnam Urban Development Authority, Port Authorities, Police Department, Transport Department, Local experts in the field of environment etc., was convened on 01.07.2010 under Chairmanship of the Collector & District Magistrate, Visakhapatnam and action plan

was discussed in detail. The stake holders agreed in principle for the implementation of action plan.

3.1 Industrial Sector:

The following major industries are existing in the bowl area:

1. M/s. Essar Steels Limited
2. M/s. Rain CII India Limited
3. M/s. Andhra Petrochemicals Limited
4. M/s. Hindustan Petroleum Corporation Limited, Visakh refinery
5. M/s. Coromandal International Limited
6. M/s. Hindustan Zinc Limited
7. M/s. Visakhapatnam Port Trust

3.1.1 PLAN OF ACTION:

Table-A

1. M/s. Essar Steels Limited,

The industry receives iron ore fines from Biladilla mines and manufactures Iron ore pellets. It uses LSHS as a fuel in the furnace, low sulphur and low ash coal in the 25 MW captive power plant. The industry has provided conveyor belts for transfer of material to port area.

	Action Point	Present status	Action plan for improvement with Target date
	A. Air pollution:		
	a) Stack emissions from the indurating furnaces.	The industry used to operate the industry with multi-cyclones. It has provided ESP's to the induarating furnaces in the year 2007 with an investment of Rs. 15 Cr and meeting the emission norms. Monitored values: <u>Pelletasation Plant - I</u> SPM – 75.7 mg/Nm3 dt: 07.05.2010 SPM – 92.0 mg/Nm3 dt: 08.06.2010 <u>Pelletasation Plant - II</u> SPM – 89.7 mg/Nm3 dt: 01.02.2010 <u>Captive Power Plant</u> SPM – 82.4 mg/Nm3 dt: 07.05.2010 SPM – 74.4 mg/Nm3 dt: 08.06.2010	Not required.
	b) Transfer points	The industry has provided bag filters/	Not required.

		scrubbers at all the important transfer points in the year 2008, with an investment of Rs. 0.18 Cr.	
	c) Online monitoring:	The industry has provided online stack analyser equipment to the indurating furnaces in the year 2006 with an investment of Rs. 0.18 Cr. It has provided one CAAQM station in order to know the status of pollution and to operate the plant in an environment friendly manner.	The industry is in the process of providing another CAAQM station, which is expected to be installed by March'2011.
	d) Green belt:	The industry has developed a green belt of 52 acres and proposes to develop additional plantation with an investment of Rs. 0.30 Cr in the vacant space available.	Plantation Started
	B. Water pollution :	Not applicable as the industry is recycling entire water and it is a negative water balanced industry.	Not required.
	C. Solid waste disposal:	The industry generates only recyleble wastes like wastes oils, used oils etc.. they are being sent to the authorised agencies.	Not required.

2. M/s. Rain CII India Limited,

The industry manufactures calcined coke. The industry receives petroleum coke as a raw material and it is fed to the rotary kiln for calcination. The gases from the kiln are fed to the incinerator to increase the residence time of the gases. The waste heat from the gases is used for steam generation and thereby electric power. The off gases from the boiler are sent to the flue gas de-sulphurization system where the gases are scrubbed with lime solution. The gases from the FGD are emitted through bag filters.

	Action point	Present status	Action plan for improvement with Target date
	A. Air pollution:		
	a. Stack emissions from the kilns.	The industry has provided flue gas de - sulpurization for the kiln off gasses. It has provided the incinerator from the gases generated during calcination. The industry is generating electricity from the waste heat recovery. The industry is meeting the emission norms. Monitored values are given below:	Not required

		WHRB – 1 SPM – 62 mg/Nm3 dt: 12.01.2010 SO2 – 36 mg/Nm3 dt: 12.01.2010 WHRB – 2 SPM – 58.5 mg/Nm3 dt: 12.01.2010 SO2 – 42 mg/Nm3 dt: 12.01.2010	
	b. Stock yards	The industry has provided MDSS to all stock yards. It has provided wind breaking wall all along the stock yards in the year 2010 on North side to avoid fugitive dust nuisance.	Not required
	c. Road sweeping:	The industry has procured a road sweeping machine with a cost of Rs. 0.25 Cr in the year 2004 and cleaning the internal roads.	Not required
	d. Online monitoring:	The industry has provided stack monitoring equipment to the kilns and has provided two CAAQM stations in order to operate the plan in environment friendly manner.	Not required
	e. Green belt:	The industry has developed a green belt of 25 acres.	Not required
	B. Water pollution :	The industry generates only cooling water as effluent. In the past the industry failed to meet the temperature parameter. In the year 2006, it provided an auxiliary cooling tower with an investment of Rs. 15 lakhs. After commissioning the new cooling tower it is meeting the temperature norms.	Not required.
	C. Solid waste disposal:	Major solid waste generation from the industry is 98 TPD of CaSO4 sludge from the flue gas de-sulphurization system. It is being sold to the brick manufactures.	Not required

3. M/s.Andhra Petro Chemicals Ltd.,

The industry produces 2 Ethyl Hexanol - 166 MTPD, Normal Butanol -78 MTPD, and Iso-Butanol-8.4 MTPD using the raw materials Propylene- 180 MTPD & Naptha- 90 MTPD. The industry recently enhanced its production capacity and up-graded the Effluent treatment plant. At present the ETP is under stabilization phase.

	Action point	Present status	Action plan for improvement with Target date
	A. Air pollution:		
	a. Stack emissions from the stacks.	The industry is using gaseous fuels and clean liquid fuels for heating purposes. All process operations are carried out in closed loop and gaseous leaks, if any, are connected to the flare	Not required.

		stacks.	
	b. Continuous monitoring	The industry has provided the CAAQM station to monitor the AAQ within the plant with an investment of Rs 0.35 Cr.	Not required.
	c. Green Belt	The industry has developed a green belt of 37 acres.	Not required.
	B. Water Pollution:	The industry generates effluent from the process and the effluent parameters in the past exceeded the standards stipulated. Now, the industry has up-graded the ETP with a cost of Rs. 2.0 Cr. At present, the ETP is under stabilization.	The ETP is expected to be stabilised by Jan'2011.
	C. Solid waste:	The industry generates wastes like Oxo- residue, Rohdium spent catalyst and ETP sludge. Oxo-residue is being used as a fuel in the plant, spent catalysts are being sent to the recyclers for regeneration, ETP sludge is being sent to the TSDF for disposal.	Not required.

4. M/s. Hindustan Petroleum Corporation Limited, Visakh Refinery

This is a 10 MMTPA Oil refinery which uses both indigenous crude and imported crude. It has facilities for manufacture of clean fuels.

	Action point	Present status	Action plan for improvement with Target date
	A. Air pollution:		
	a. Stack emissions from the stacks.	M/s. HPCL (Refinery) has installed three Sulphur recovery units with an investment of Rs.160 Crores in the year 1999 to minimize SO2 emissions and is recovering 2200 tons of elemental Sulphur per month. The Refinery has provided 65 TPD of sulphur recovery unit along with clean fuel project with an investment of Rs.80 Crores during 2009. The industry has connected hot well off gases of CDUs to the Burners to minimize odour nuisance during the year 2007-08. The industry is using low sulfur fuels (0.5 by weight %) for their	The Refinery has proposed to provide flue gas De-sulphurisation to FCCUs as a part of clean fuel project to reduce SPM & SO_2 emissions in the Ambient Air further with an investment of Rs.120 Crores. Target date- March,2011.

		requirements and ensuring that the total SO_2 emissions from the refinery are not exceeding 11.5 TPD.	
	b. Continuous monitoring	M/s. Hindustan Petroleum Corporation Ltd., commissioned online analyzers to 19 stacks and 3 CAAQM stations were established to monitor the pollutants SPM, SO_2, NOx, HC, CO with an investment of Rs.5 Crores.	Not required.
	B. Water Pollution:	The Refinery has constructed ETP-I in 1993 and ETP-II in 1996 to meet the MINAS standards and it has has completed Oil Ingress project in 2009 to avoid entry of excess oil into ETP with an investment of Rs.7.2 Crores and is meeting the standards .	
	C. Solid waste:		
	a. Oily wastes:	Oil is recovered since 2002 from High Oil sludge and Low Oil Sludge, sent to Bio-remediation pit and the same is reprocessed. The industry is in the process of sending the wastes to the authorised recyclers.	
	b. other solid wastes :	In addition to the oily wastes, the refinery generates spent catalysts etc., which can be used for recycle purpose. The industry is in the process of sending these wastes to the authorised recyclers.	

5. M/s. Coromandal International Limited,

The industry manufactures Complex Fertilizers, Sulphuric Acid & Phosphoric Acid by using Sulphur, Rock Phosphate, MOP, Urea and Ammonia as basic raw materials. During 1997, the industry closed the urea plant permanently and during 1999-2000, the industry closed ammonia plant permanently.

	Action point	Present status	Action plan for improvement with Target date
	Stoppage of operation	The industry stopped ammonia production and urea plant in the year 1999. The industry de-commissioned pressurized NH3 storage tank and commissioned two atmospheric storage tanks of 5000 Tons	

		each. The industry is importing NH3 through ships and through a pipeline to the premises. During 1997, the industry established molten sulphur facility and minimized solid sulphur consumption gradually thereby avoiding fugitive emissions.	
	A. Air pollution:		
	Receipt & transport of raw materials	The industry provided Screw un loader at Wharf area to unload raw material of Sulphur, Rock Phosphate, etc., in place of Bucket Conveyor with an investment of **Rs.19 Crores.** It has a dedicated raod from the wharf area to the plant premises.	Not required.
	Fugitive emissions from the warehouse	The industry has provided telescopic chute in the warehouse in the year 2010 with an investment of **Rs. 0.30 Cr.**	Not required.
	Sulfuric acid plants	The industry has revamped 1400 TPD DCDA Sulfuric acid plant in the year 2002 with an investment of Rs.8 Crores. The industry provided alkali scrubber to the 300 TPD and 1400TPD sulphuric acid plants to minimize the emissions i.e., SO2, SO3 & Acid mist with an investment of **Rs.1.65 Crore.** **<u>Monitored Values</u>** **1400 TPD Sulphuric Acid Plant** SO_2 – 178.1 mg/Nm^3 Dt. 15.02.2010 SO_3 – 38.2 mg/Nm^3 Dt. 15.02.2010 Acid mist ND Dt. 15.02.2010 **300 TPD Sulphuric Acid Plant** SO_2 – 200.9 mg/Nm^3 Dt. 15.02.2010 SO_3 – 24.6 mg/Nm^3 Dt. 15.02.2010 Acid mist ND Dt. 15.02.2010	Not required.
	Reduction of fuel consumption	The industry has stopped fuel consumption in the complex fertilizer plants by installing air pre-heater by utilizing exothermic heat generated during reactions, in the year 2006 with an investment of **Rs.6.5 Crores.** The industry has Stopped 6MW DG set and the required power is being generated from	Not required.

		turbo generator, where the steam generated from the sulfuric acid plants is used. The project was implemented in the year 2005.	
	Online Monitoring:	The industry has provided online stack analysers to Sulphuric acid plants for continuous monitoring of SO2 with an investment of **Rs. 0.16 Cr.** The industry has established one CAAQM station for continuous monitoring of SPM, RSPM, SO2, Fluorine and ammonia with an investment of **Rs.0.3 Crores.**	The industry is proposing to provide another CAAQM station in the premises, which is expected to be commissioned by February 2011.
	B. Water Pollution	The industry is having an ETP comprising neutralization and clari-flocculators, which requires up-gradation.	The industry is constructing a new ETP with an investment of **Rs. 16 Cr,** which is expected to be commissioned by March' 2011.
	C. Solid waste disposal		
	Gypsum disposal	The industry has an accumulated huge quantity of Gypsum in an area of about 100 Acres. The industry adopted dry disposal system of Gypsum and provided lining to an extent of 5 acres of existing Gypsum pond with an investment of **Rs. 24 Crores** during April'2009 which eliminated huge generation effluent from the gypsum pond. The industry has provided HDPE & Geo membrane liner under the wagon loading area where gypsum is stored and transported from, during June 2010, to prevent contamination due to acidic seepages in the surroundings with a cost of **Rs.7.5 Crores.**	As per the directions of A.P. Pollution Control Board the entire gypsum stored in old yard of 100 Ac shall be disposed off before December 2010. (Present accumulation of Gypsum is about 15,00,000 T and generation is 6,00,000T. The industry is disposing at a rate of 12,00,000 to 14,00,000 TPA. The industry reported that they may not be able to dispose entire gypsum by Dec'2010 and requested that it may be extended for one more year)
	Other Solid wastes	The industry generates other solid wastes like spent catalysts, acid residues etc., which are being disposed as per the Hazardous Waste Authorization.	Not required.

6. M/s. Hindustan Zinc Limited

M/s. Hindustan Zinc Limited, established in 1977, used to produce Zinc & Lead. Pollution Problems were more when the lead plant was in operation. As there was no improvement in the situation, A.P. Pollution Control Board issued Closure Order to the Lead Plant of H/s. Hindustan Zinc Ltd., on 07.06.1999. Accordingly, M/s. Hindustan Zinc Ltd., stopped the Lead Plant operation and removed it completely. During 2000, the industry revamped the Zinc plant and converted its process to Jarosite process.

	Action point	Present status	Action plan for improvement with Target date
	A. Air pollution:		
	Receipt & transport of raw materials	The industry used to receive its raw-material from mines through wagons. While unloading it used to cause fugitive emissions. During 2010, the industry has stopped receiving its ore concentrate through wagons and started to receive by containers.	Not required.
	Sulfuric acid plant	The industry has commissioned Tail Gas Treatment Plant (for reducing SO2 emissions after recovery of SO2 in acid plant) in the year 1991. It has Installed a new TGT plant for minimizing the SO_2 emissions with an investment of Rs.12 Crores during March'2009. At present stack emissions are meeting the standards. **Monitored Values** **TGT stack** SO_2 – 116.0 mg/Nm^3 Dt. 09.08.2010 Acid mist – ND Dt. 09.08.2010	Not required.
	B. Water Pollution	The industry used to discharge treated effluent into the Meghadrigedda overflow channel canal. The industry provided RO system and mechanical vapour recompression system to recover water from the effluent and using it in the process, thereby reducing fresh water consumption to implement zero discharge system during the year 2010.	

		The industry has constructed additional concrete lined storage tank of 2 days capacity between clarifier and RO plant to store effluent during RO plant stoppages and to treat all the effluent through RO plant during 2010. The industry has provided water meters with totalisers at outlet of clarifier, feed to RO plant, totaliszer at Mechanical Vapour Recompression (MVR) to monitor the quantity of effluent treated in ETP during 2010. The industry has provided HDPE pipelines to convey industrial effluent from different plants to the ETP, in place of existing open drains, during 2010 there by reducing the chance of ground water contamination.	
	Solid Waste disposal		
	Jarosite	The industry constructed a secured land fill for safe disposal of jarosite cake in the year 2000 with an investment of Rs. 10 Cr. It has provided a new onsite secured landfill to dispose hazardous wastes generated in the plant during June'2009 with an investment of Rs.10 Crores.	
	Closure of the Jarosite Pond	The industry has started the work for closure of the old landfill.	December 2011
	Moore Cake	The industry has an accumulated storage of moore cake, which is generated before 2001 in the premises.	APPCB has directed the industry to dispose the entire Moore cake by Dec'2010. (Present stock of the Moore cake is about 80,000T and disposing at a rate about 2000 TPM. In addition, the industry has consigned 5000T to Chaina and 8000T to Dabare Zinc Smelter, Rajastan for recovery of Zinc.) The industry has sought permission to dispose the

			accumulated moore cake into the landfill. Target date = December 2011.
	Other Solid wastes	The industry is disposing of all the hazardous wastes from the premises as per the directions of the Board.	

7. M/s. Visakhapatnam Port Trust,

M/s. Visakhapatnam Port Trust, Visakhapatnam was established during 1933 in the east coast of Andhra Pradesh and increased to 25 breaths to handle different types of cargoes in different forms. A.P. Pollution Control Board is regularly monitoring the Port activities and issuing directions as and when required. M/s. Visakhapatnam Port Trust has initiated major projects for mechanization of the cargo handling facilities and clearances are yet to be obtained.

	Action point	Present status	Action plan for improvement with Target date
	A. Air pollution:	M/s VPT is taking measures, with a view to get improvement in the surrounding environment and reduction in levels of RSPM & TSPM in the Ambient Air. M/s VPT is carrying out water sprinkling round the clock with an increased frequency on all the dusty cargo handling/storage areas. Dusty cargo stacking in the areas abutting residential locality was stopped. High capacity trucks were introduced to transport the coking coal from GCB to yards duly providing covers, thereby reducing the movement of number of trucks and dust fly-off. M/s. VPT is ensuring that adequate spare sprinklers are available for immediate replacement of damaged	M/s. VPT proposes to mechanize the coal handling at the GCB. M/s. VPT proposes to isolate the dusty cargo by constructing a wall up to a height of 7M and geo-net above the wall for a height of 4M. Mechanical Dust Suppression System will be provided all along the wall to eliminate the dust emissions from the stock yard. Wall construction is going on, the target date for mechanisation is June'2012. M/s. VPT proposes to reorganize the cargo handling in the berths and stock yards with a view to control dust nuisance. M/s. VPT is in the process of mechanization of stocking, loading and unloading of dusty cargo like coal and iron ore to eliminate the truck movement (about 6000 nos./day), and thus avoid dust

		sprinklers and to ensure continuous operation of all the sprinklers. M/s. VPT has provided water meters with totalizers to record the quantity of water used for sprinkling purpose. VPT has provided truck tyre washing facility to avoid dust transfer onto other roads. M/s. VPT has provided Mechanised Dust Suppression System at 3 major stock yards and West Quay Berths during 2002 with an investment of Rs.14 Crores. VPT is using treated sewage for dust suppression. M/s. VPT has provided geo-net barrier at General Cargo Berth (GCB) area for a length of 240 mts with an investment of Rs.40 Lakhs. M/s. VPT has provided covering to conveyor belt to an extent of 100 M from Junction Houses H7 & H8 with an investment of Rs.50 Lakhs to minimize dust emissions.	emanation. These improvements are expected to be completed by 2012.
		M/s. Visakhapatnam Port Trust & NHAI completed the flyover connecting NH-5 and Port with an investment of Rs. 116 Crores. By utilizing this flyover, the dusty cargo truck movement through residential /commercial areas has been eliminated.	
	B. Water Pollution	VPT provided a 10 MLD sewage treatment plant for sewage generated in the city area with an investment of Rs. 3 Crores. The treated sewage is being used for dust suppression purpose in port area.	

3.1.2 Financial Plans:

Table-B

Sl. No	Name of the industry	Investment made for treatment system for the past ten years i.e., 1999 to 2008 earlier (in Crores)	Investment made for up-gradation of treatment system during 2009 – 2010 (including future proposed investments (in Crores)	Time Schedule
1.	M/s. VisSakhapatnam Port Trust Line of activity: Handling of various cargoes.	Rs. 134.0 Cr	Rs. 1125.0 Cr.	**June,2012**
2.	M/s. Essar Steels Limited, Line of activity: Iron ore pelletization	Rs.26.5 Cr	Rs.3.5 Cr	**March,2011**
3	M/s. Rain CII India Limited, Line of activity: Calcination of Petroleum Coke	Rs.6.5 Cr	Rs.1.5 Cr	**December,2010**
4.	M/s.Andhra Petro Chemicals Ltd., Line of activity: Petrochemical industry	Rs.6.0 Cr	Rs.1.95 Cr	**January,2011**
5	M/s. Hindustan Petroleum Corporation Limited, Visakh Refinery Line of activity: Petroleum refinery	Rs.175 Cr	Rs.217.2 Cr	**March,2011**
6	M/s. Coromandal Fertilizers Limited, Line of activity: Manufacture of complex fertilizers	Rs.87.0 Cr	Rs.27.0 Cr	**March,2011**

7	M/s. Hindustan Zinc Limited, Line of activity: Manufacture of Zinc	Rs.16.0 Cr	Rs.40.0 Cr	**December,2011**

3.2 Sewage Treatment in Visakhapatnam City:

Sl. No	Particulars	Present status of pollution control systems	Action plan for further improvement.	Time Schedule
	Grater Visakhapatnam Municipal Corporation (GVMC)	• M/s.VPT has provided 10 MLD sewage treatment plant in the port area for handling & treatment of sewage generated from part of Visakhapatnam city. The treatment is based mainly on activated sludge process. • The entire area of GVMC has been divided into 20 sewerage blocks for the sake of taking up of sewerage system in the city in a phased manner. • The area of GVMC is 530 Sq.Kms. and the population as per 2001 census is 14.35 Lakhs. The sewage generated at an average of 100lpcd is 143.50 mld as per 2001 census. • The population covered so far with UGD system comes to nearly 22.15% and the length of sewerage net work covered is 212.00Kms.Two STPs of 25 mld(Rs.10.00	• The project of providing sewerage system to central part of Visakhapatnam city under JNNURM has been taken up in four packages and is in progress. Nearly 37.15% of GVMC population (2001 census) will be covered after completion of the project. The length of sewerage net work that is being covered is 400.00 Kms. Two STPs of 13 mld capacity (nearing completion) and 108 mld capacity are being taken up in this project. The cost of the above STPs is Rs.10.50 Crores & Rs.47.00 Crores respectively. • The Detailed Project Report for Gajuwaka, Malkapuram and Yarada covering nearly 23.00 % of population of GVMC (2001 census) at an estimated cost of Rs.386.10 Crores was submitted to Govt. of	**December,2010**

		Crores) & 38 mld (Rs.20.00 Crores) were constructed and are functioning.The sewage after treatment is being let out into the sea . The quantity of sewage treated at present in the above two STPs is 40.00 mld.	India for approval. Three STPs of 53 mld (Rs.37.17 Crores); 30 mld (Rs.26.83 Crores) and 5 mld (Rs.7.75 Crores) are proposed in this Project. • A Project Report has been approved by the State Govt. for providing sewerage system to the rest of the population (i.e., in the surrounding villages that were merged into GVMC) covering nearly 11.00% of GVMC population as per 2001 census. The DPR is under preparation. In this project 3 Nos. of STPs of 15 mld (Rs.8.25 Crores); 32 mld (Rs.17.60 Crores) and 13 mld (Rs.7.15 Crores) are proposed. • In addition to the above the GVMC has been providing sewerage system to the public living in (5+11=16) 16 poor settlements duly covering nearly 6.70% of GVMC population (2001 census) 4 No. of STPs are proposed @ an estimated cost of Rs.11.15 Crores. • The STPs proposed by GVMC comprising of manly activated sludge process. The GVMC also called for Expression of Interest (EOI) from the concerned persons for utilization of treated water. • GVMC proposed to treat	

			to a BOD of 20 mg/lit, COD of 25 mg/lit and SS of 60 mg/lit.	

Sl. No	Particulars	Present status of Sewage treatment systems	Action plan for further improvement.	Time Schedule
1.	Grater Visakhapatnam Municipal Corporation (GVMC)	The GVMC is operating the following STPs	The GVMC is in the process of providing the following STPs	
		1. A 10 MLD Plant in the Port area for treatment of sewage generated from part of One Town. This is being operated by M/s. Visakhapatnam Port Trust, and the treated sewage is being utilised by the Port for suppression of dust i.e. emanated from dusty cargo stock piles.	1. A 13 MLD plant at Mudasaralova, catering to the projected population of 2.5 lakhs is completed, and the network connections from the households are in progress. The treated sewage is proposed to be discharged into Sea.	December, 2010
		2. A 25 MLD plant at Appughar on the Beach Road catering to the population of 2 Lakhs is being maintained by M/s. GVMC, and the treated sewage is discharged into Sea.	2. A 54 MLD plant at Narava is in construction stage, and would be completed within an year. This STP is proposed to cater the projected population of 5 lakhs, and the treated sewage is proposed to be discharged into Sea.	December 2011

		3. A 38 MLD plant catering to the population of 2.5 lakhs is in operation at One Town. Part of the treated sewage is being used by M/s. Essar Steels Limited for its industrial use, and the remaining treated sewage is discharged into Sea.	3. A 54 MLD plant at Old Town is proposed in the next phase. This STP is proposed to cater the population of 5 lakhs, and the treated sewage is proposed to be discharged into Sea.	December 2013

		GVMC constructed Below Poverty Line housings under Wambay and Rajeev Gruha kalapa along with packaged STP's of 2 x 1.5 MLD and 1 x 2 MLD to cater to the population of 28,280 in total.	If the above STPs come into operation, the projected population covered under the UGD system comes to nearly 70 % and the length of sewage network covered will be 111 Sq. Kms. At present the GVMC population is 16 lakhs.	
		4. GVMC constructed settlement housings at Gangavaram along with packaged STP's of 1 x 0.5 MLD and 1 x 2.5 MLD to cater to the population of 25,000 in total.	Core coverage in city with population of 70 % of population and 25% of habitation area. Suburbs would be covered and connected in phased manner under JNNURM^{+} Project which is to be completed by 2015.	
		The population covered under the above STPs and the UGD system comes to nearly 5 lakhs and the length of sewage network covered is 78 Sq.Kms.	<u>Other Civic Amenties proposed by GVMC under JNNURM projects</u>. Ist Phase JNNURM (2005-2012) <u>Flyover</u> Railway station to Asilmetta 1.55 Kms with a project cost of Rs 89 Crores.	July 2011
			<u>BRTS</u> Pilot corridor about 40 Kms with an estimated cost of Rs 360 Crores.	September 2011

			Truck terminal GVMC earmarked truck terminals at Madhurawada and Gajuwaka at suburbs areas and are operational.	Already commissio ned
			IInd Phase JNNURM+ (2012-2015) Flyovers GVMC proposed flyovers at Gopalatanam and Chavulamadum with lengths of 1500 M and 800 M respectively	2012 - 2015
			BRTS Additional 7 Nos Corridors of about 100 Kms, Arterial roads of about 15 kms, Feeder roads of about 20 Kms and Pedestrial Footpath of about 6 Kms with a total (Flyover and BRTS) estimated project proposal of Rs. 2250 crores.	2012 – 2015
			Traffic Infrastructure for the traffic islands would be provided by GVMC and operational system maintained by traffic police.	

3.3 Municipal Solid waste Management

- Greater Visakhapatnam Municipal Corporation (GVMC) is one of the major cities in Andhra Pradesh generating about 670 TPD of municipal solid waste (MSW). At present this waste is being disposed at Kapulauppada (V) which is not scientific disposal site.

- The GVMC identified 2 sites one at Tarluvada (V) (500 Ac) and another site at Krishnapuram (350 Acs) for scientific disposal of MSW. The proposals for

alienation of these sites were sent to District Collector, Visakhapatnam and it would be cleared by December 2010. Proposals for setting up scientific landfill and a bio-methanization plant with a cost of Rs.104 crores were already prepared by GVMC.

- After completion of the alienation process, at one of the above mentioned sites, the construction will be taken up by GVMC. It is scheduled to go for a scientific solid waste management facility by December, 2011.

3.4 Bio-Medical waste Management

- The Visakhapatnam District is having 324 Health Care Establishments (HCEs) covering about 7671 beds. In the bowl area there are 7 Government Hospitals, 190 Private hospitals and others are 3 Nos.
- The HCEs are having authorization of A.P. Pollution Control Board under the BMW Rules and has tied up with Scientific Common Bio Medical Waste Treatment Facility i.e., M/s.Maridi Eco Industries (Andhra) Pvt. Ltd, located at Sy.No.314, Kapuluppada (V), Visakhapatnam District.

- The capacity of the Incinerator is 250 Kg/hr. The hospital waste collecting by the common waste facility (CBMWTF) from the bowl area is around 400 kg/day.

- APPCB has been monitoring the HCEs as well as the Common Treatment Facility regularly.

3.5 Vehicular pollution Control:

- The transport department is implementing emissions norms stipulated to the vehicles and monitoring pollution levels through testing centers for which licenses are issued by transport department under the A.P. Motor Vehicles Rules.

- Pollution Under Control (PUC) certificates are issued for the vehicles which passes the test and notices will be issued to the vehicles which fails to comply with the norms. The Validity of the Pollution Under Control certificate is 6 months from the date of issue. There are 40 test centres existing in Visakhapatnam.

- As per the G.O.Ms. No. 238, Dt. 23.11.2006 of the Government of Andhra Pradesh, Green Tax is being levied as follows.

Sl. No.	Class of Vehicles	Tax Levied
1.	Transport Vehicles that have completed 7 years of age from the date of their registration	Rs. 200/- (per annum)
2.	No-Transport vehicles that have completed 15 years of age from the date of their registration	

3.	Motor Cycles	Rs. 250/- (for 5 years)
4.	Other than Motor Cycles	Rs. 500/- (for 5 years)

- There will not be any levy of Green Tax if the vehicle is operated by LPG, CNG, battery or solar power.

- The Green Tax has been imposed with a view of discouraging old vehicles. Lead free petrol has been made available in the Visakhapatnam.

3.5.1 Additional Tax on Second Vehicle:

To discourage purchase of more vehicles by an individual, Government is taxing more on second/ subsequent vehicle.

Sl. No	Type of vehicle	At the time of registration of 1st Vehicle	Second of subsequent vehicle
1.	Motor Cycles	9 % of the cost of the Vehicle	14 % of the cost of the Vehicle
2.	Four wheeler motor vehicles whose cost is below Rs. 10 Lakhs	12%	14%
3.	Four wheeler motor vehicles whose cost exceeds Rs. 10 Lakhs	14%	14%
4.	All vehicles owned by companies/ institutions	14%	14%

3.6 Continuous Monitoring proposals by APPCB:

APPCB proposes to monitor the pollutants on continuous basis by setting up two continuous ambient air monitoring and noise monitoring stations one at Visakhapatnam Port Trust and the other one in the Mulagada village.

3.7 Further Actions proposed:

1. Toll free number is being started to register public complaints.
2. Installation of video cameras in the premises of all the major industries by focusing on the main sources of process emissions and video recording

emissions generated by industries during night time so that the same can be used for cross verification by PCB.

3. Monitoring of VOCs in industrial areas during night times and also extending monitoring in the surrounding villages.
4. **APPCB will ensure the linkage of Continuous Ambient Air Quality Monitoring Stations installed by the concerned industries with the web sites of State Board and CPCB by 31st March, 2011.**

5. **Presently, the manifesto system is being followed during the transportation of Hazardous wastes from Industries to TSDF, Parwada, Vishakapatnam District. APPCB In-consultation with Road Transport Authority proposes to take-up GPS based transportation and tracking system for transportation of hazardous waste.**

6. Appointment of local area representatives in each industrial estates to monitor compliances.
7. Continuous monitoring of process emissions of all the major industries.
8. VOC monitoring within the industrial premises, at industrial estates and also in the surrounding villages.
9. Monitoring of noise levels within the industries and adjacent villages.
10. Monthly monitoring of ground water quality in the industrial areas and surrounding villages.

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Annexure-I

ANNUAL AVERAGE VALUES (ug/M3) AT VARIOUS LOCATIONS IN VISAKHAPATNAM CITY DURING 2000 -2009

Parameter-RSPM (in ug/nm3)

	MINDI	INDUSTRIAL ESTATE	POLICE BARRACKS	INS VIRBAHU	SEETHAMMADHARA	GNANAPURAM AREA	ST. ALOYSIUS SCHOOL	ST. JOHNS PARISH SCHOOL	MCV KALYANA-MANDAPAM
2000	66.1	50.4	83.5				71.9	82.4	77.3
2001	78.7	73.6	95.8				76.4	83.7	82.4
2002	84.6	84.5	97.5				71.3	76.5	76.4
2003	91.7	88.6	95.5				74.2	75.2	74.1
2004	97.6	90.8	92.5	76.4	80.0		79.5	78.9	75.2
2005	105.8	95.5	101.6	76.1	80.7		91.2	92.3	84.9
2006	103.3	92.4	101.3	78.7	90.6	141.3	84.2	86.4	81.3
2007	97.3	92.4	102.8	77.1	88.9	90.7	91.3	95.7	89.1
2008	76.4	90.7	93.7	67.8	88.9	113.1	84.3	91.9	80.5
2009	93.5	76.7	95.8	66.0	89.5	126.7	93.2	108.9	88.4
STD	**60**	**120**	**60**	**50**	**60**	**60**	**60**	**60**	**60**

Parameter-TSPM(ug/nm3)

	MINDI	INDUSTRIAL ESTATE	POLICE BARRACKS	INS VIRBAHU	SEETHAMM-ADHARA	GNANAPURAM AREA	ST. ALOYSIUS SCHOOL	ST. JOHNS PARISH SCHOOL	MCV KALYANA-MANDAPAM
2000	116.8	107.0	186.5				170.8	207.7	160.7
2001	146.3	143.8	193.9				152.2	165.8	157.0
2002	171.0	170.6	204.0				148.5	158.4	155.2
2003	179.9	183.9	200.7				151.0	154.3	152.0
2004	195.0	184.4	186.3	155.6	161.9		162.2	162.5	155.3
2005	213.7	194.7	202.0	156.1	163.5		185.6	187.1	173.6
2006	209.0	186.6	203.4	160.7	181.8	263.4	171.1	173.8	166.4
2007	196.0	182.9	207.1	157.4	180.4	263.4	187.3	193.9	179.6
2008	161.5	135.9	227.4	142.0	178.5	248.4	196.1	236.1	171.8
2009	184.6	174.4	241.7	142.9	202.2	289.1	224.7	307.3	220.4
STD	**140**	**360**	**140**	**70**	**140**	**140**	**140**	**140**	**140**

ANNUAL AVERAGE VALUES (ug/M3) AT VARIOUS LOCATIONS IN VISAKHAPATNAM CITY DURING 2001 – 2009

Parameter -SO2(ug/nm3)

	MINDI	INDUSTRIAL ESTATE	POLICE BARRACKS	INS VIRBAHU	SEETHAMM-ADHARA	GNANAPURAM AREA	ST. ALOYSIUS SCHOOL	ST. JOHNS PARISH SCHOOL	MCV KALYANA-MANDAPAM
2001	13.2	13.2	14.5				9.0	8.7	
2002	9.7	7.4	9.1				5.9	5.1	4.1
2003	7.3	5.2	6.1				7.6	7.5	7.0
2004	10.9	10.3	10.1	9.7	10.1		10.4	10.3	10.3
2005	12.3	12.0	12.1	11.1	11.3		13.3	13.1	12.7
2006	11.5	11.3	11.1	10.0	11.2	12.1	10.3	10.3	10.2
2007	8.6	8.2	8.7	8.2	8.5	8.4	8.4	8.6	8.4
2008	11.1	8.4	12.9	12.1	8.5	11.9	23.6	15.5	11.5
2009	22.7	7.4	14.7	11.1	8.4	13.7	26.7	20.1	16.3
STD	**60**	**80**	**60**	**15**	**60**	**60**	**60**	**60**	**60**

Parameter-NOx(ug/nm3)

	MINDI	INDUSTRIAL ESTATE	POLICE BARRACKS	INS VIRBAHU	SEETHAMM-ADHARA	GNANAPURAM AREA	ST. ALOYSIUS SCHOOL	ST. JOHNS PARISH SCHOOL	MCV KALYANA-MANDAPAM
2001	19.0	21.8	28.1				14.2	15.4	
2002	24.0	21.8	24.9				10.7	11.1	10.2
2003	28.6	23.2	29.4				21.7	21.4	21.8
200	32.7	31.7	32.4	31.1	31.7		28.5	28.3	28.2

4									
2005	34.8	34.3	34.5	32.7	32.8		37.4	37.6	36.5
2006	33.1	31.8	32.6	30.9	30.8	33.5	36.7	36.6	36.5
2007	30.9	30.0	31.1	29.9	30.2	30.4	36.7	33.5	33.0
2008	26.6	27.2	33.0	27.9	30.6	32.8	33.0	30.6	27.7
2009	28.7	23.6	37.7	28.1	29.3	33.1	32.7	26.7	29.4
STD	**60**	**80**	**60**	**15**	**60**	**60**	**60**	**60**	**60**

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