NCL INDUSTRIES LIMITED

CEMENT DIVISION

AN ISO 9001 : 2008 COMPANY

CIN : L33130TG1979PLC002521

// REGISTERED POST A/D//

NCL/ QC/2018-19/ 516 DT: 29.09.2018

To

The Member Secretary,
TSPC Board,
Paryavaran Bhavan,
A-3, Industrial Estate,
Sanathnagar,
HYDERABAD – 500 018.

Sub: Submission of Environmental Statement Audit Report Form – V for the Year 2017 -18.
Ref: Consent Order No: - TSPCB/NLG/HO/CFO/2018 - 4061; Dated: 07/03/2018

Dear Sir,

This is reference to the above cited subject, we are here with submitting three copies of environmental statement Audit Form –V for the year 2017- 2018.
Kindly acknowledge the receipt of the same.

Thanking you,

Yours faithfully,

For NCL INDUSTRIES LIMITED

S. Chakradhar

S. CHAKRADHAR
PRESIDENT – WORKS

Encl: As above.

D/C Copy to: The Environmental Engineer, TSPC Board, Regional Office,
H.No.8-15,1st Floor, Sri Laxmi Complex,Near RTA office,
Sri Vinayak Nagar,NALGONDA 508 201, TELANGANA.

Factory : Simhapuri, Mattapalli Village, Mattampalli Mandal, Suryapet Dist.,-508 204, T.S.
Tel : 08683-227630, Fax: 08683-227629 E-mail : nclworks@nclind.com

4th Floor, Vaishnavi's Cynosure, Near Gachibowli Flyover, Gachibowli, Hyderabad -500 032. India.
Tel : 91-40-30120000, 29807868 / 69 Fax : 91-40-29807871, E-mail: ncl@nclind.com | www.nclind.com

FORM - V

ENVIRONMENTAL STATEMENT (AUDIT) REPORT

2017-2018

M/S. NCL INDUSTRIES LTD

(CEMENT DIVISION)
SIMHAPURI, MATTAPALLI (V),
MATTAMPALLI (M) SURYAPET (DIST).

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FORM – V

(See Rule 14)

ENVIRONMENTAL STATEMENT (AUDIT) REPORT

FOR THE FINANCIAL YEAR ENDING 31st MARCH, 2018

PART - A

i) Name and address of the owner/ occupier of the industry operation or process.	:	**M/s. NCL INDUSTRIES LTD.,** (Cement Division) Simhapuri, Mattapalli (V), Mattampalli (M) Suryapet (Dist).
ii) Date of the last Environmental Audit Report submitted	:	
iii) Production Capacity (Units)	:	Clinker 7800 TPD (2.6 MTPA) Cement 6120 TPD (2.0 MTPA)
iv) Year of Establishment	:	Line- 1 1984 Line -2 2010 Line-3 2017

PART - B

WATER AND RAW MATERIAL CONSUMPTION

i) Water consumption (m^3 /day) : 900

1. Process & Cooling - 650
2. Domestic - 250

Name of Products	Water consumption per unit of products (KL/MT)	
	During the previous financial year (2016-2017)	During the current financial year (2017-2018)
Ordinary Port Land Cement	0.248	0.235

ii) Raw material consumption:

Name of raw materials	Name of product	Consumption of raw material per unit of output (Ton/Ton)	
		During the previous financial year (2016-2017)	During the current financial year (2017-2018)
1. Lime Stone	Clinker	1.358	1.36
2. Aluminum Laterite	Clinker	0.063	0.059
3. Iron ore	Clinker	0.029	0.03
4. Coal	Clinker	0.176	0.164
5. Gypsum	Cement	0.043	0.035
6. Fly Ash	Cement	0.080	0.093

PART - C

POLLUTION DISCHARGED TO ENVIRONMENT

(Parameter's as specified in the consent issued)

Pollutants	Quantity of Pollutants Discharged (kg/day) 2017-2018	Concentrations Of Pollutants in Discharges (mg/L) 2017-2018	Percentage of variation from prescribed standards with reasons
a) **Wastewater:** There is no process waste water generation only domestic sewage is the only waste water source it is sent to septic tank followed by soak pit.			

b) Air

Stack Attached to	Pollutants	Quantity of Pollutants in Emissions (kg/day) 2017-2018	Concentrations Of Pollutants in Emissions (mg/ N m^3) 2017-2018	Percentage of variation from prescribed standards with reasons
Line 1 Kiln /Raw Mill	SPM	109.74	24	20.61% less
Line 1 Cooler	SPM	27.93	22	26.06 % less
Line 1 Cement Mills	SPM	15.72	21	29.44 % less
Line 1 Coal Mill	SPM	11.76	25	15.15 % less
Line 1 Packing plant	SPM	3.71	25	17.50 % less
Line 2 L.S. Crusher	SPM	23.07	26	14.44 % less
Line 2 Kiln /Raw Mill	72.50	78.97	21	31.67 % less
Line 2 Cooler	SPM	65.57	20	35.00 % less
Line 2 Cement Mill	SPM	8.52	20	32.78 % less
Line 2 Packing Plant	SPM	8.58	24	19.17 % less
Line 2 Coal Mill	SPM	60.28	24	18.61 % less

Line 3 Kiln	SPM	106.10	18	40.83 % less
Line 3 Cooler	SPM	74.94	19	35.83 % less
Line 3 Cement Mill	SPM	12.20	13	55.83 % less
Line 3 Packing Plant	SPM	4.11	9	71.33 % less

PART - D

HAZARDOUS WASTE

(As specified under hazardous wastes/Management and handling rules, 1989)

Hazardous Wastes	Total Quantity per year	
	During the previous financial year (2016-2017)	During the current financial year (2017-2018)
a) From Process	-N.A-	-N.A-
b) From Pollution control facilities	-N.A-	-N.A-

PART - E

SOLID WASTES

	Total quantity MT per year	
	During the previous financial year (2016-2017)	During the current financial year (2017-2018)
a) From Process	-NA-	-N.A-
b) From Pollution Control Facility	-NA-	-N.A-
c) Quantity recycled or re-utilized	-NA-	-N.A-

PART – F

Please specify the characteristics (in terms of concentration and quantum) of Hazardous as well as solid wastes and indicates disposal practice adopted for both these categories of wastes.

There is no hazardous waste generated. Solid waste from pollution control equipment is taken into the process again.

PART – G

Impact of the pollution control measures on conservation of natural resources and consequently on the cost of production.

Pollution control measures for different stacks in cement plant results in saving natural resources and most of dust is either from intermediate stage or final product. By controlling emissions, the management can avoid unnecessary loss.

PART - H

Additional investment proposal for environmental protection including abatement of pollution.

About 32,545 samplings (including mines/haulage roads) were planted during 2017-2018. The growth of greenery is visibly aesthetic around the plant, colony and mines. The plant too has the monitoring equipment.

PART - I

Any other particulars in respect of environment protection and abatement of pollution.

The Management's objective is to achieve the production without affecting the physical, chemical and biological environments of the near by vicinity.

Industry has taken lot of efforts to raise the plantation in and around the plant premises even though the land is unfavorable for plantation due to rocky nature of the soil. The green canopy in and around the factory stands as an example for efforts made by industry in the barren land.

1. INTRODUCTION

M/s. NCL INDUSTRIES LTD., (Cement Division) has setup a cement plant to manufacture Ordinary Portland Cement and Portland Pozzalona Cement at Simhapuri, Mattampally Mandal of Suryapet (Dist) of Telangana. The Plant is established in the year of 1984 with capacity of 1800 T/day Line-I. Line-II was installed and commissioned on April 2010 with capacity of 3000 T/day. And line - III installed and commissioned on March 2018 with capacity of 3000TPD. Present the total plant producing from three lines clinker capacity is 7800TPD (2.6 MTPA) and Cement manufacturing capacity is 6120 TPD (2.0 MTPA).

2. OBJECTIVE OF THE STUDY

The objective of the present study is to review the performance of pollution control systems installed by the industry so as to identify efficient pollution prevention and control systems which could be beneficial to both environment and its components. And also **Inserted by rule 2 of the Environment (Protection) second Amendment & Rules, 1992 vide G.S.R. 329 (E), dated:13-3-1992.** Every person carrying on an Industry, operation or process requiring consent under section 25 of the water (prevention and control of pollution) Act 1974 (6 of 1974) or under section 21 of the Air (Prevention and Control of Pollution), Act 1981 (14 of 1981) or both or authorization under the Hazardous wastes (Management and Handling) Rules, 1989 issued under the Environmental (Protection) Act 1986 (29 of 1986) shall submit an environmental audit report for the financial year ending 31st March in Form - V to the concerned state pollution control board on or before the 30th day of September every year beginning 1993.

3. Benefits of Environmental Audit

Environmental audit creates awareness in the conservation of natural resources and helps to improve production safety and health. The benefits of audits are:

1. It helps in reduction of raw material consumption by way of waste minimization and adoption of recovery of waste and recycles the same.
2. Determined the performance of process systems and helps to improve the systems.
3. Efficiency of pollution control systems can be calculated.
4. This gives the awareness of environmental organization in the industry.
5. Data available will help the management for use in the plant modification and adopting pollution control for different types of technology.
6. It helps to identify pollution creating systems and exposure to it by the employees for taking remedial measures.
7. The management will be assisted in complying with local, regional and national laws regulations by adopting standards.
8. It helps to identify hazardous wastes, handling measures taken and exposure to litigation can be reduced.
9. To determine the impact on the surrounding environment due to the disposal of its pollutants and identify suitable preventive measures.
10. Energy saving systems can be adopted by considering fuel consumption data.

4. LOCATION:

The Industry is located In Simhapuri, Mattapalli Village, Mattampally Mandal of Suryapet District of Telangana, The project site falls under the latitudes of 16^0 40' & 16^0 45'N and longitudes of 79^0 45' & 79^0 50'E(Toposheet No. 56 P/14). The unit is located about 1.5 km due NNE of Mattapalli village. The village is located on the northern bank of Krishna river. The project is rocky in nature the site comes under Arid Zone. The Plant Location map of the project is shown in fig 1.

5. RAW MATERIAL AND PRODUCTS

Raw material and products used/produced in the financial year 2017-2018 are as follows:

5.1 Raw Materials

1.	Lime Stone	-	21,56,631	MT/year
2.	Coal	-	2,60,049	MT/year
3.	Aluminum Laterite	-	82,935	MT/year
4.	Gypsum	-	38,789	MT/year
5.	Iron Ore/Iron Powder	-	57,305	MT/year
6.	Fly ash	-	1,04,739	MT/year

5.2 Products

1.	Clinker	-	15, 82,885 MT/year
2.	Cement	-	11,19,299 MT/year

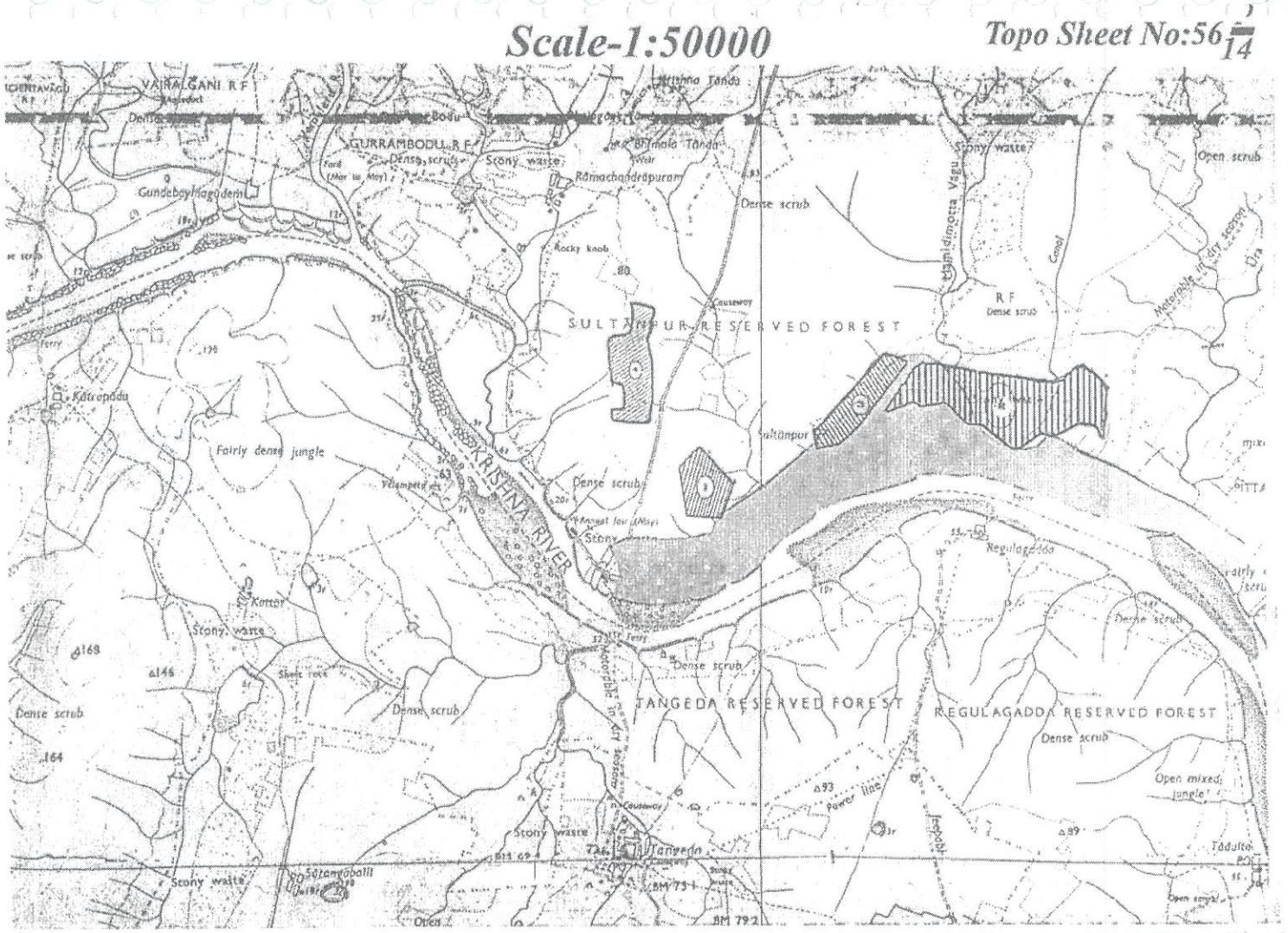

Fig. 1. Location Map of M/s. NCL Industries Ltd., (Cement Division)

6. PROCESS DESCRIPTION

The cement manufacturing process is dry process. The crushed lime stone is fed into the ball mill (raw mill) along with iron ore, Aluminum Laterite. The mixture is pulverized into fine powder. The cement clinker is produced from rotary kiln at 1400^0C. This temperature is attained in the rotary kiln by firing the pulverized coal from the coal mill bin. The clinker along with fly ash and gypsum is fed to the ball mill (cement mill) and is ground to fineness which becomes cement. Cement is stored in the storage silos and packed in 50 kg packs by packing machine in the packing section, whenever required.

7. WATER REQUIREMENT

The total consumption is 900 m^3/day and the break details are given below:

1. Process and cooling - 650 m^3/day
2. Domestic - 250 m^3/day

Most of the process and cooling water will be evaporated / consumed. The domestic requirement includes requirements of colony, plantation, drinking as well as sanitation. The water requirement is being met by pumping water from the Krishna River.

8. POLLUTION CONTROL IN THE PLANT

The industry has given top priority for pollution prevention and control. Provided water spray system at lime stone crusher dump hopper to suppress dust emissions. PJBH & RABH Bag filters are attached to Kilns to control air emission. Bag filters are connected to raw mill, coal mill, packing plant and cement mills. Electrostatic Precipitators are connected to coolers. To control the secondary fugitive emissions water sprinkling is adopted. High efficiency bag filters are installed at various transfer points to control the emissions.

- PJBH for Kiln -1 & Raw Mill
- RABH for Kiln -2 & VRM
- PJBH for Kiln -3
- ESP for Cooler -1 & 2 & 3
- Bag Houses for Coal Mill -1&2
- Bag Filters for Lime stone crushers 1& 2
- Bag Houses for Cement Mills Line-1 & 2 & 3
- Bag Filters for Packing Plants -1 & 2 & 3
- Bag Filters at various transfer points

8.1 Waste water Source

Most of the water used in the process as well as cooling is consumed / evaporated. Domestic wastewater is only wastewater source. Domestic wastewater is being treated in the Sewage Treatment Plant (STP) 250KLD located in the colony. The Treated water is being used for Green Belt development & Gardening purpose.

8.2 Air Pollution Control

8.2.1 Stack Emissions

The emissions from Kiln are emitted through the stack via PJBH for Line-I and RABH for Line-II and PJBH for Line-III which reduces the particulate matter to the minimum levels. The emissions from cooler are emitted through stack after passing through ESP Electrostatic Precipitator, which reduces the particulate matter to the lower levels. The bag filters attached to L.S. Crusher, Raw Mill, Cement Mill, Coal Mill & Packing Plant reduces the particulate matter emissions to below the prescribed limit. The emissions from the stack attached to the kiln are monitored for the parameters like SPM,NO_X and SO_X. The emissions from the stack attached to the Crusher, Raw Mill, cement mill, coal mill, packing plant and cooler are monitored for SPM the data presented in Table 1 shows that the monitored values for different parameters are meeting the T.S. Pollution Control Board Standards.

TABLE - 1

NCL INDUSTRIES LIMITED: SIMHAPURI					
Source of Pollution and Details of Air Pollution Control Systems Average values of Stack Emissions monitoring data					
S.No	**Source of Pollution**	**Pollution Control Equipment Provided**	**Stack Height in Mts above GL**	Stack Dia (m)	Concentration (mg/Nm³) SPM
1	Attached to Kiln -1 & Raw Mill-1	Pulse Jet Bag Filter	110	2.7	24
2	Attached to Kiln -2 & Raw Mill-2	RABH	140	2.5	21
3	Attached to Kiln -3	Pulse Jet Bag Filter	130	7.0	18
4	Attached to Cooler-1	ESP	55	1.6	22
5	Attached to Cooler- 2	ESP	55	2.6	20
6	Attached to Cooler -3	ESP	55	4.3	19
7	Attached to Coal Mill-1	Bag Filter	30	0.8	25
8	Attached to Coal Mill-2	Bag Filter	50	2.2	24
9	Attached to Cement Mill-1	Bag Filter	30	1.2	25
10	Attached to Cement Mill-2	Bag Filter	39	0.9	24
11	Attached to Cement Mill-3	Bag Filter	55	1.6	13
12	Attached to Packer-1	Bag Filter	30	0.5	25
13	Attached to Packer-2	Bag Filter	30	0.8	24
14	Attached to Packer-3	Bag Filter	30	0.97	9
15	Attached to Lime Stone Crusher	Bag Filter	20	1.25	26

8.2.2 Ambient Air Quality

Ambient air quality monitoring is carried out once in a month at the following locations in the factory premises to know the status of the ambient air quality.

1. Security
2. Guest house
3. Colony
4. Time office

Note: The Ministry of Environment and Forest (MOEF) New Delhi, has given amendment on 16th November 2009 for revised standards for Ambient Air Quality Standards. M/s. NCL Industries Ltd., has following the same Standards.

Ambient air quality is monitored for 8 hours at each station for the estimation of particulate matter - PM_{10}, particulate matter - PM2.5, sulphur dioxide and Nitrogen dioxide. Average values for the parameters monitored are presented in the table 9.3. The analyzed values for PM_{10}, $PM_{2.5}$, SO_2 and NO_2 are within the limits prescribed by T.S.P.C.B.

TABLE - 2

Average values of Ambient air quality data

	Near Security	Near Guest House	Near Colony	Time Office
Particulate Matter - PM_{10}	73	53	61	70
Particulate matter - $PM_{2.5}$	30	18	23	28
Sulfur dioxide	11	8	10	9
Oxides of Nitrogen	24	18	20	22

Note: All the values are expressed as ($\mu g/m^3$)

9. GREENBELT DEVELOPMENT

Greenery / plantation recharges oxygen into environment. Greenbelt development may have the following benefits.

a. Mitigation of fugitive emissions including odour
b. Noise pollution control
c. Improving the local echo-system
d. Arresting the soil erosion
e. Improving the landscape of the area
f. Aesthetics

The greenbelt development programme in this rocky strata area is as follows:

Every year **Rs. 25.0 Lakhs (Rupees Twenty Five Lakhs only)** is ear marked for greenbelt development programme. For this year 1,00,000 saplings, separate manpower is engaged to take care of these saplings. Presently $50m^3$/day of water is used for greenbelt development programme.

10. PROPOSED BUDGET FOR POLLUTION CONTROL & ENVIRONMENT PROTECTION.

The budgetary allocation for the financial year 2018 - 2019 is **Rs. 2.5 Crores (Rupees Two Crores Fifty Lakhs only)** which includes **Rs. 25.0 Lakhs (Rupees Twenty Five Lakhs only)** for greenbelt development programme and **Rs. 2.25 Crores (Rupees Two Crores and twenty Five lakhs only)** for rural welfare and maintenance of pollution control equipment.

11. House Keeping

Roads and open area in the plant are concreted, Road sweeping machine is engaged to keep the plant and colony premises neat tidy.

12. CONCLUSIONS

The NCL Industries Ltd., (Cement Division) is manufacturing Clinker 7800 TPD and Cement 6120 TPD. PJBH and RABH attached to Raw Mill and Kilns Line-I, II, III are effectively arresting the particulate matter. Bag filters are attached to the Cement Mill, Coal Mill and Packing Plant is effectively arresting the emissions. Electro Static Precipitator attached to the Coolers Line I, II & III effectively working, to conclude the industry is abating the pollution effectively.

13. AUDITOR'S COMMENTS

1. The audited figures show that the consumption of water is decreased by 0.013 KL/MT of product.
2. The fugitive emissions in Plant & Colony areas are within the prescribed limits of TSPCB.
3. The audit activities have enabled the authorities to control fugitive emissions and water consumption efficiently.
4. During the financial year 2016-2017, Rs. 4.7 Crores (Rupees Four Crore and Seventy lakhs only) spent on environmental protection and social welfare activities by the management of NCL.

NCL INDUSTRIES LTD. SIMHAPURI

Auditors Signature

APPENDIX-A

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 16th November, 2009.

NATIONAL AMBIENT AIR QUALITY STANDARDS

G.S.R. 826 (E) In exercise of the powers conferred by section 6 and section 25 of the Environment (Protection) Act, 1986, (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:-

1. (1) These rules may be called the Environment (Protection) seventh Amendment Rules, 2009.
   (2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, (hereinafter referred to as the said rules), In rule 3, in sub-rule (3B), for the words, brackets, figures and letters, "In columns (3) to (5) of Schedule VII" the words, brackets figures and letters "in columns (4) and (5) of Schedule VII" shall be substituted.

3. For Schedule VII to the said rules and entries relating thereto, the following Schedule and entries shall be substituted, namely:--

S. No.	Pollutant	Time weighted average	Concentration in Ambient Air		
			Industrial , Residential, Rural and Other area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1.	Sulphur dioxide (SO_2), $\mu g/m^3$	Annual Average*	50 $\mu g/m^3$	20 $\mu g/m^3$	1. Improved West and Gaeke Method 2. Ultravoilet Fluorescence
		24 hours**	80 $\mu g/m^3$	80 $\mu g/m^3$	
2.	Nitrogen Dixodie (NO_2) $\mu g/m^3$	Annual Average*	40 $\mu g/m^3$	30 $\mu g/m^3$	1. Modified Jacob & Hochheiser (Na-Arsenite) Method 2. Chemiluminescence
		24 hours**	80 $\mu g/m^3$	80 $\mu g/m^3$	
3.	Particulate Matter (Size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual Average*	60 $\mu g/m^3$	60 $\mu g/m^3$	1.Gravemetric 2. TOEM 3. Beta attenuation
		24 hours**	100 $\mu g/m^3$	100 $\mu g/m^3$	
4	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ $\mu g/m^3$	Annual Average*	40 $\mu g/m^3$	40 $\mu g/m^3$	1. Gravimetric 2. TOEM 3. Beta attenuation
		24 hours**	60 $\mu g/m^3$	60 $\mu g/m^3$	
5.	Ozone (O_3) $\mu g/m^3$	8 hours	100 $\mu g/m^3$	100 $\mu g/m^3$	1. UV photometric 2. Chemilminescence 3. Chemical Method
		1 hour	180 $\mu g/m^3$	180 $\mu g/m^3$	
6.	Lead (Pb) $\mu g/m^3$	Annual Average*	0.50 $\mu g/m^3$	0.50 $\mu g/m^3$	1. AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper 2. ED-XRF using Teflon filter
		24 hours**	1.0 $\mu g/m^3$	1.0 $\mu g/m^3$	

7.	Carbon Monoxide (CO) mg/m^3	8 hours**	02 mg/m^3	02 mg/m^3	Non dispersive infra Red (NDIR) spectroscopy
		1 hour	04 mg/m^3	04 mg/m^3	
8.	Ammonia (NH_3) $\mu g/m^3$	Annual Average*	100 $\mu g/m^3$	100 $\mu g/m^3$	1. Chemiluminescence 2. Indophenol blue method
		24 hours**	400 $\mu g/m^3$	400 $\mu g/m^3$	
9.	Benzene (C_6H_6 $\mu g/m^3$)	Annual Average	05 $\mu g/m^3$)	05 $\mu g/m^3$)	1. Gas chromatography based continuous analyzer 2. Adorption and Desorption followed by GC analysis
10.	Benzo (a) Pyrene (BaP) particulate phase only, ng/m^3	Annual Average	01 ng/m^3	01 ng/m^3	Solvent extraction followed by HPLC/GC analysis
11.	Arsenic(As) ng/m^3	Annual Average	06 ng/m^3	06 ng/m^3	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12.	Nickel (Ni), ng/m^3	Annual Average	20 ng/m^3	20 ng/m^3	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

- Annual Arithmetic mean of minimum 104 measurements in a year at particular site taken twice a week 24 hourly at uniform intervals.
-

** 24 hourly / 8 hourly or 01 hourly monitored values, as applicable, shall be complied with the 98% of the time in a year. 2 % of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits Specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

APPENDIX-B

Standards for stack emissions

Chimney Nos	Parameter	Emission Standards (mg/Nm3)
1 to 16	Particulate Matter	30 mg/Nm3
1,2 & 3	Sulphur Dioxide (So2)	100 mg/Nm3
	Oxides of Nitrogen (Nox)	800mg/Nm3 for Rotary Kiln with in Line Calciner (ILC) Technology
	HCL	10mg/nm3
	HF	1 mg/Nm3
	TOC	10mg/Nm3
	Hg and its compounds	0.05 mg/Nm3
	Cd +TI and their compounds	0.05 mg/Nm3
	Sb +As+Pb+Co+Cr +Cu+Mn+Ni+V and their compounds	0.05 m/nm3
	Dioxins and Furan	0.1 ngTEQ/Nm3

APPENDIX - C

AMBIENT NOISE STANDARDS

SCHEDULE (see rule 3(1) and 4(1))

Ambient Air Quality Standards in respect of Noise

Area code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:-

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.

APPENDIX – D

General Standards for Discharge of Effluents

The effluent discharged shall comply with the tolerance limits mentioned below:

(a)

Outlet	Parameter	Limiting Standards
1	pH	6.5 – 8.5
	Total Suspended Solids	100 mg/l
	Oil and Grease	10 mg/l
	Biochemical Oxygen Demand (3 days at 27^0 C)	100 mg/l
	Chemical Oxygen Demand	250 mg/l
	Total Dissolved Solids (TDS)	2100 mg/l

APPENDIX-E
TEST CHARACTERISTICS FOR DRINKING WATER (IS:10500-1991)

Sl. No.	Substance of Characteristic	Require-ment (Desira-ble Limit)	Undesirable Effect outside the Desirable Limit	Permissible Limit in the Absence of Alternative Source	Methods of Test (Ref. To IS)	Remarks
1	2	3	4	5	6	7
Essential Characteristics						
i.	Colour, Hazen units, max	5	Above 5, consumer acceptance decreases	25	3025 (Part 4): 1983	Extended to 25 only if toxic substances are not suspected, in absence of alternative sources.
ii.	Odour	Unobject ionable	---	---	3025 (Part 5): 1983	a. Test cold and when heated b. Test at several dilutions
iii.	Taste	Agreeab le	---	---	3025 (Part 7 & 8): 1984	Test to be conducted only after safety has been established
iv.	Turbidity, NTU, max	5	Above 5, consumer acceptance decreases	10	3025 (Part 10): 1984	---
v.	p^H value	6.5 – 8.5	Beyond this range the water will affect the mucous membrane and/or water supply system	No relaxation	3025 (Part 11): 1984	---
vi.	Total Hardness (as $CaCO_3$) mg/L, max	300	Encrustation in water supply structure and adverse effects on domestic use	600	3025 (Part 21): 1983	---
vii.	Iron (as Fe), mg/L, max	0.3	Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures and promotes iron bacteria	1.0	32 of 3025:1964	---
viii.	Chlorides (as Cl), mg/L, max	250	Beyond this limit, taste, corrosion and palatibility are affected	1000	3025 (Part 32): 1988	---
ix.	Residual, free Chlorine, mg/L, min	0.2	---	---	3025 (Part 26): 1986	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is requierd, it should be min. 0.5 mg/L
Desirable Characteristics						
x.	Dissolved Solids, mg/L, max	500	Beyond this palatability decreases and may cause gastro intestinal irritation	2000	3025 (Part 16): 1984	---
xi.	Calcium (as Ca), mg/L, max	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 40): 1991	---
xii.	Copper (as Cu), mg/L, max	0.05	Astringent taste, discolouration and corrosion of pipes, fittings and utensils will be caused beyond this	1.5	36 of 3025: 1964	---
xiii.	Manganese (as Mn), mg/L, max	0.1	Beyond this limit taste/ appearance are affected, has adverse effect on domestic uses and water supply structures	0.3	35 of 3025: 1964	---
xiv.	Sulphate (as SO_4), mg/L, max	200	Beyond this causes gastro intestinal irritation when magnesium of sodium are present	400 (see col.7)	3025 (Part 24): 1986	Max be extended up to 400 provided (as Mg) does not exceed 30
xv.	Nitrate (as NO_3), mg/L, max	45	Beyond this methaemoglobinemia takes place	100	3025 (Part 34): 1988	---
xvi.	Fluoride (as F), mg/L, max	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	23 of 3025: 1964	---

Sl. No.	Substance of Characteristic	Requirement (Desirable Limit)	Undesirable Effect outside the Desirable Limit	Permissible Limit in the Absence of Alternative Source	Methods of Test (Ref. to IS)	Remarks
1	2	3	4	5	6	7
xvii	Phenolic compounds (as C_6H_5OH), mg/L, max	0.001	Beyond this, it may cause objectionable taste and odour	0.002	54 of 3025: 1964	—
xviii.	Mercury (as Hg), mg/L, max	0.001	Beyond this, the water becomes toxic	No relaxation	(see Note) Mercury ion analyser	To be tested when pollution is suspected
xix.	Cadmium (as Cd), mg/L, max	0.01	Beyond this, the water becomes toxic	No relaxation	(see Note)	To be tested when pollution is suspected
xx.	Selenium (as Se), mg/L, max	0.01	Beyond this, the water becomes toxic	No relaxation	28 of 3025: 1964	To be tested when pollution is suspected
xxi.	Arsenic (as As), mg/L, max	0.05	Beyond this, the water becomes toxic	No relaxation	3025 (Part 37): 1988	To be tested when pollution is suspected
xxii.	Cyanide (as CN), mg/L, max	0.05	Beyond this, the water becomes toxic	No relaxation	3025 (Part 27): 1986	To be tested when pollution is suspected
xxiii.	Lead (as Pb), mg/L, max	0.05	Beyond this, the water becomes toxic	No relaxation	(see Note)	To be tested when pollution/ plumbosolvency is suspected
xxiv.	Zinc (as Zn), mg/L, max	5	Beyond this limit, it can cause astringent taste and an opalescence in water	15	39 of 3025: 1964	To be tested when pollution is suspected
xxv.	Anionic detergents (as MBAS), mg/L, max	0.2	Beyond this limit, it can cause a light froth in water	1.0	Methylene-blue extraction method	To be tested when pollution is suspected
xxvi.	Chromium (as Cr^{+6}), mg/L, max	0.05	May be carcinogenic above this limit	No relaxation	38 of 3025: 1964	To be tested when pollution is suspected
xxvii	Polynuclear aromatic hydrocarbons (as PAH), g/L, max	—	May be carcinogenic	—	—	—
xxviii	Mineral Oil, mg/L, max	0.01	Beyond this limit, undesirable taste and odour after chlorination take place	0.03	Gas Chromato-Graphy method	To be tested when pollution is suspected
xxix	Pesticides, mg/L, max	Absent	Toxic	0.001	—	—
xxx	Radioactive materials: a. Alpha emitters, Bq/L, max b. Beta emitters, pci/L, max	— —	— —	0.1 1	— —	— —
xxxi	Alkalinity, mg/L, max	200	Beyond this limit, taste becomes unpleasant	600	13 of 3025: 1964	—
xxxii	Aluminum (as Al), mg/L, max	0.03	Cumulative effect is reported to cause dementia	0.2	31 of 3025: 1964	—
xxxiii	Boron, mg/L, max	1	—	5	29 of 3025: 1964	—

Note: Atomic Absorption Spectrophotometer method, may be used.

APPENDIX-F
PLANT SPECIES FOR GREEN BELT DEVELOPMENT

Sl. No.	BOTANICAL NAME	COMMON NAME	SIZE AND TYPE SUITABLE SIZE
1.	Acia auriculaeformis (Mimosaceae)	H: Vilaiti	M: Semi evergreen fragrant white flowers. Suitable in green belts on road sides.
2.	Adina cordifolia (Rubiaceae)	T: Pasupukadamba H: Haldu	L: Deciduous a light demander, suitable on open areas & near flares.
3.	Aequle marmelos (Rutaceae)	T: Bilavamu H: Bael	M: Deciduous, good for green belts for green belts near temples.
4.	Anogeissus latifolia (Combretaceae)	T: Chirimanu H: Dhaura	M: Deciduous, good for green belts near temples
5.	Artabotrys hexapetius (Annonaceae)	T: Monaranjani H: Hara Champa	S: Evergreen shrub with fragrant flowers good for gardens & inside boundary wall and long canals.
6.	Averrhoa carambola (averrhoaceae, Oxalidaceae)	T: Kamaarakkarmel H: Kamrak	S: Semi evergreen good in narrow belts (green belts <50m width) along channels
7.	Azadirachta indica (Meliaceae)	T: Vepachettu H: Nim	L: Evergreen, suitable in green belts and out side office & hospital buildings
8	Bauhinia Variegata (Caesalphiniaceae)	T: Devakanchanamu H: Rachanaram	M: Deciduous, good in green belts, garden and as a second row avenue tree.
9.	Borassus flabellifer (Arecacese; Palmae)	T: Taadi H: Tad	L: A tall deciduous, palm, can be used as wind break when of different age.
10.	Bosellia serrata (Burseraceae)	T: Phirangi saambraani H: Kunder	M: Deciduous suitable on green shallow soils.
11.	Burera serrata (Bureraceae)	T: Chitreka	M: Deciduous suitable on shallow soils as a green belt or avenue tree.
12.	Butea monosperma (Fabaceae)	T: Mlduga H: Palas	M: Deciduous for green belt and as a second row avenue tree.
13.	Caesalpinia pulcherrima (Leguminosae)	T: Pamiditangedu H: Gulutora	M: A large shrub suitable for gardens outside office and along channels
14	Callistemon lanceolatus (Myrtaceae)	T: Bottle Brush	M: Deciduous for some time, ornamental plant in garden
15.	Careva arobora (Lecythidaceae)	T: Araya H: Kumbi	L: Deciduous, good in green belts.
16.	Carrisa carandas (Apocynaceae)	T: Vaka H: Karaunda	S: semi evergreen, large bushy shrub, good as a hedge to protect against noise.
17.	Caryota urenus (Palmae)	T: Jilugujattu H: Mari	M: A lofty palm, good as a wind break.
18.	Cassia fistula (Leguminosaae)	T: Rela H: Amaltas	M: Deciduous good ornamental tree in green belt.
19	C. Siamea	T: Sima Tangedu	L: Evergreen good as avenue tree
20.	Casuarina equisetifolia	T: Sarugudu H: Jungli s aru	M: Evergreen, suitable for covering low-lying areas and in green belt.
21.	Cadrela toons	T: Nandichettu H: Mahanim	L: Deciduous, good in open spaces, in green belts and along ponds.
22.	Cestrum diurnum	H: Din-ka-maja	S: A shrub with white fragrant flowers, suitable (solanaceae) around boilers and waste disposal sites. **(Contd..)**

PLANT SPECIES FOR GREEN BELT DEVELOPMENT

Sl.No.	BOTANICAL NAME	COMMON NAME	SIZE AND TYPE SUITABLE SIZE
23.	Cleistanthus collinus (Euphorbiaceae)	T: Kadishe H: Garari	S: Deciduous tree suitable in green belts.
24.	Cocus nucifera (palmae)	T: Kobbarichettu H: Nariyal	L: A tall stately palm suitable on sea shore river banks and hill slopes.
25.	Clestanthus collinus (Leguminosae)	T: Errasissu H: Shisham	M: Deciduous, suitable on areas around flare sites and in green belts.
26.	Delomix regia (Leguminosae)	T: Shimasankesual H: Gulmohar	M: Deciduous ornamental, suitable on road sides.
27.	Dillenia inidica	T: Peddakalinga H: Chalta	L: Evergreen, white fragrant flowers, goon in green belts and around waste disposal sites.
28.	D. pentagyna	T: Chinnakalinga H: Aggai	L: Deciduous, good in green belts and onsite around flare.
29.	Emblica officianallis (Euphorbiaceae)	T: Amalakamu H: Amla	M: Deciduous, good as isolated trees in garden
30.	Erythrina suberosa (Leguminosae)	T: Barijama H: Dauldhak	M: Deciduous, good in green belts
31.	E. variegata	T: Badisa H: Dadap	M: Deciduous, good in gardens outside office buildings.
32.	Ficus bengalensis (Moraceae)	T: Marri H:Bargad	L: Deciduous, widely spread avenue tree (15 m apart)
33.	F. religiosa	T: Bodhi H:Pipal	L: Deciduous, widely spaced avenue tree also a single tree in isolated sites.
34.	Emelina arborea (Verbenaceae)	T: Gumartek H: Sewan	M: Deciduous, good in green belts around flare sites.
35.	Grewia tiloifolia (Tiliaceae)	T: Charachi H: Dhamim	M: Deciduous, good in green belts for use as timber
36.	Hamelen patens		S: Evergreen shrub with dense atractive foliage of greenish bronze leaves; good in gardens.
37.	Hardwicka binata (Leguminosae)	T: Yepi H: Anjan	M: Deciduous, good for green belts on shallow soils.
38.	Hibiscus mutabilis (Malvaceae)	H: Sthal Kamal	S: Large bushy shrub, semi evergreen good in green belts & in gardens, along channels.
39.	H.Rosa sinensis	T: Java Pusphamu	S: Evergreen woodly showy shrub good for gardens.
40.	Lxora arborea	T: Korivipala H: Navari	S: Much branched evergreen, good in green belts and in gardens.
41.	Lxora coccinea	T: Mankana H: Rangan	S: Much branched evergreen, good in garden and in green belts.
42.	Jasminum sambur (Oleaceae)	T: Boddumalle H: Moghra	s: Much branched evergreen, good in garden and in green belts.
43.	Kydia calycina (Malvaceae)	T: Potri H: Pula	S: Deciduous, good along canals and in green belts.
44.	Lagersteoemia speciosa (Lythaceae)	T: Varagogu H: Jarul	M: Deciduous, good along road sides and in garden (Contd..)

PLANT SPECIES FOR GREEN BELT DEVELOPMENT

Sl.No.	BOTANICAL NAME	COMMON NAME	SIZE AND TYPE SUITABLE SIZE
45.	Lannea coramandelica (Anacardiaceae)	T: Appriyada H: Jhingan	L: Deciduous, good on well drained green belts and around flares.
46.	Lawsonia alba (Lythraceae)	T: Goranti H: Mehndi	S: Glabrous much branched shrub, good along canal sides.
47.	Locbnera rosea (Apocyenaceae)	T: Bilaganuueru H: Sadabahar	S: An erect perennial herb; good in garden and along small channels.
48.	Madhuca indica (Sapotaceae)	T: Ippa H: Mahua	M: Deciduous, good in green belts
49.	Mallotus philippensis (Euphorbiaceae)	T: Kunkuma H: Sidur	S: small evergreen good along channels
50.	Melia azedarach (Meliaceae)	T: Turaka Vepa H: Bakain	M: Deciduous good along small roads, and canals.
51.	Millingtonia hortensis (Bignoniaceae)	T: Kavuki H: Akas Nim	L: Semi evergreen flowers fragrant, good along roadsides.
52.	Mimusops elengi (Sapotaceae)	T: Pogada H: Maulsari	M: Evergreen, good for avenues
53.	Moringa oleifera (Moringaceae)	T: Muluga H: Sainjna	M: Deciduous, with fragrant flowers, good in green belts.
54.	Murrava koenigi (Rutaceae)	T: Karepaku H: Mitha neem	S: Semi evergreen good in green belts and along small channels
55	Oreodoxa reqia (Palmae)	Royal palm	L: Semi evergreen good medium and small road sides as an ornamental plant.
56.	Pandanus odoratissimus (Pandanaceae)	T: Mugali H: Kewada	S: A densely branched shrub good in gardens near seashore
57.	Peltophorum inerme (Leguuminosae, Caesalphiniaceae)	T: Kondachinta	M: Semi evergreen, suitable on road sides, in in gardens & outside buildings.
58.	Plumeria acuuminata (Apocynaceae)	T: Vaala Ganneru H: Golainchi	M: Semi evergreen, fragrant white flowers, good in green belts.
59.	Plumeria alba	T: Veyui Varahaalu	S: Semi evergreen good for gardens
60.	Plumeria rubra	T: Nurruvarahalu H: Golainchi	S: semi evergreen good for gardens
61.	Pterocarpus marsupium (Leguminosae, Paplionaceae)	T: Vegi H: Bija	M: Deciduous, good on open areas with adequate light
62.	Pogamia pinnata (Leguminosae, Paplionaceae)	T: Ganuuga H: Karanj	M: Deciduous, good along roads & canals.
63.	Rauvolfa serpentina (Apocynaceae)	T: Paataalagani H: Chandrabhaga	S: An erect evergreen perennial shrub good along canal.
64.	Salmalia malabarica	T: Booruga H: Semul	M: Deciduous, Good for avenues
65.	Samanea saman (Leguminosae)	T: Nidraganneru	L: Deciduous, good tree along road sides for shade.
66.	Saraca indica (Leguminosae, Caesalpinaceae)	T: Ashoka H: Asok	M: Evergreen tree good on road sides within campus

(Contd..)

PLANT SPECIES FOR GREEN BELT DEVELOPMENT

Sl.No.	BOTANICAL NAME	COMMON NAME	SIZE AND TYPE SUITABLE SIZE
67.	Spathodia campanulata (Bignoniaceae)	T: Patadiya H: Rungtora	L: In gardens and avenues and in green belts, it is deciduous.
68.	Sykzygium cumini (Myyrtaceae)	T: Neeredu H: Jaman	L: Evergreen tree, good in green belts and within campus and road sides.
69.	Tabernamontana coronaria (Apocynaceae)	T: Gandhitagarapu H: Chandni	S: An evergreen shrub good in gardens and along canals.
70.	Tabebuia pentaphylla (Bignomiaceae)		M: Deciduous, good in gardens
71.	Tamarindus indica (Leguminosae,Caesalphiniaceae)	T: Chintachettu H: Imli	L: Semi evergreen tree along state & national highways suitable site.
72.	Ticoma stans (Bignomiaceae)	T: Pachgotla	L: Evergreen tree, good in garden and along canals.
73.	Tectona grandis (Verbenaceae)	T: Adviteeku H: Sagwan	M: Deciduous, good in green belts and on inner sides of roads.
74.	Terminalia alata (Combretaceae)	T: Tani H: Sain	L: Deciduous, good in green belts near flare site
75.	Terminalia arjuna	T: Yerramadi H: Arjuna	L: Evergreen tree for road sides and in green belts.
76.	Terminalia bellirica	T: Tani H: Bahora	L: Deciduous, good in green belts.
77.	Terminalia bellirica	T: Badamchettu d H: Deshi Badam	L: Deciduous tree good near sea shore.
78.	Thespesia populanea (Malvaceae)	T: Gangaraavi H: Paras Pipal	M: Compact quick growing evergreen tree good along road sides.
79.	Thevetia peruviana (Apocynaceae)	T: Pachaganneru H: Pile, Kaner	S: An evergreen large shrub, has shady yellow, flowers, good around the waste treatment.
80.	Vitex negundo (Verbenanceae)	T: Vaavili H: Sambhaluu	S: A large shrub suitable on areas along channels and streams and on waste lands.
81.	Xylia xyicarpa (Eguminosae, Minosaceae)	T: Eravalu H: Jambu	L: Deciduous is green belts and on waste lands
82.	Zanthoxyium (Rutaceae)	T: Rhetsamaramu H: Badrang	M: Deciduous in green belts and on waste lands

NOTE: H Denotes Name in Hindi
T " Name in Telugu
S " Small size
L " Large size
M " Medium size