NOTE ON
ENVIRONMENTAL IMPACTS
DUE TO USE OF PET COKE AND RICE HUSK IN ADDITION TO COAL
IN
CEMENT PLANT AND CAPTIVE POWER PLANT

FOR
AMENDMENT IN ENVIRONMENTAL CLEARANCE
(EC Granted :J-11011/36/2007-IA II(I) dated 18th May, 2007)

Submitted under Clause 7 (II)

AT

ACC Limited

Bargarh Cement Works
Cement Nagar, Bardol, Khaliapali, Bargarh, Orissa

Prepared By

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SECUNDERABAD-500017

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1.0 INTRODUCTION

ACC Ltd is operating Bargarh Cement Works (BCW) since1968. ACC – BCW have been granted Environmental Clearance (EC) vide Ministry of Environment &Forest(MoEF) vide letter no. J-11011/36/2007-IA II(I) dated 18th May, 2007

ACC-BCW obtained all statutory approvals from the State Pollution Control Board and the plant is in operation with the following capacity.

a. Cement Plant – 2.50 MTPA
b. Captive Power Plant– 2 X 15 MW
c. Coal Washery – 100 TPH

2.0 PRESENT PROPOSAL

ACC proposes to use Petcoke and rice husk (to the extent available) in addition to coal in the Kiln of cement plant and boilers of captive Power plant due to inadequate coal supply. Present proposal is for obtaining Amendment in Environmental Clearance from MoEF&CC for use of Petcokeand Rice Husk (in proportion based on the availability) in addition to Coal in cement plant and captive power plant.

A comparison of the statement showing the key parameters for EC granted and EC amendments sought is given below

S. No.	Particulars	Existing Environmental Clearance (EC)	Proposed EC Amendment	Remarks
	CEMENT PLANT			
1	Capacity	2.5 MTPA	2.5 MTPA	No Change
2	Fuel	Coal	100 % PetCoke Or 100 % Coal	Use of pet coke & rice husk (to the extent available) in addition to coal
3	Heat Input	100 % by coal	100 % by Petcoke Or 100 % by coal Or 100% combination of petcoke & Coal in required	Use of Petcoke or coal Additionally, Rice Husk will be used in proportion with coal or petcoke

S. No.	Particulars	Existing Environmental Clearance (EC)	Proposed EC Amendment	Remarks
			proportionate	
4	Quantity of Fuel, TPD*	Coal –515	Pet coke –302 TPD (max), Or Coal – 515 TPD (max)	Petcoke or Coal will be used in any proportion Additionally, Rice Husk of 140 TPD (max) in proportion with coal or petcoke will be used based on the availability.
5	Net Calorific value of fuel (Kcal/ Kg of fuel)	3500 (coal)	3500 (coal), 8000 (Pet Coke), 2600 (Rice Husk)	-
6	Sulphur content in fuel (%)	0.40 max. (Coal)	0.40 max. (Coal), 6% max. (Pet Coke),	-
7	Max. PM in stack flue gases			
a)	Kg/Hr	Coal – 16.7	Pet coke - 10.0 or Coal - 10.0	-
b)	Mg/Nm^3	50	30	Complying with new emission standard while usage of Petcoke, Coal, Rice husk and decrease in dust emission load
8.	Max. SO_2 in stack flue gases			
a)	Kg/Hr	Coal – 9.32	Pet coke – 9.32 or Coal - 9.32	-
b)	Mg/Nm^3	100	100	Complying with new emission standard while usage of Petcoke, Coal & Rice Husk.
9.	Max. NOx in stack flue gases			
a)	Kg/Hr	Coal – 533.0	Pet coke – 267.26 or Coal - 267.26	-
b)	Mg/Nm^3	1595	800	Complying with new emission standard

S. No.	Particulars	Existing Environmental Clearance (EC)	Proposed EC Amendment	Remarks
				while usage of Petcoke, Coal & Rice Husk. NOx control measures like process optimization/meal split/ fuel split/meal curtain/Calciner firing location/fluxes utilization/Alternative Fuels/SNCR.
	CAPTIVE POWER PLANT			
1	Capacity of Captive Power plant	2 X 15 MW	2 X 15 MW	No Change
2	Number of Boilers	2	2	No Change
3	Type of boiler	Circulating Fluidised Bed Combustion (CFBC)	CFBC	No Change
4	Number of Steam Turbines	2	2	No Change
5	Heat Input	100 % by coal	100 % by Petcoke Or 100 % by coal Or combination of petcoke & coal in required proportionate	Use of Petcoke or coal Additionally, Rice Husk will be used in proportion with coal or petcoke
6	Fuel requirement (tones per day)*	Coal - 609 (max)	Petcoke - 266.4 Or Coal 609	Petcoke or Coal will be used in any proportion depending upon the availability. Additionally, Rice Husk of 100 TPD (max) in proportion with coal or petcoke will be used based on the availability.
7	Net Calorific value of fuel (Kcal/ Kg of fuel)	3500 (coal)	3500 (coal), 8000 (Pet Coke), 2600 (Rice Husk)	-
8	Sulphur	0.40 max.	0.40 max.	-

S. No.	Particulars	Existing Environmental Clearance (EC)	Proposed EC Amendment	Remarks
	content in fuel (%)	(Coal)	(Coal), 6% max. (Pet Coke),	
9.	Max. PM in stack flue gases			
a)	Kg/Hr	Coal – 15.98	Pet coke – 15. 98 or Coal -15.98	
b)	Mg/Nm^3	50	50	
10.	Max. SO_2 in stack flue gases			
a)	Kg/Hr	Coal - 203.0	Pet coke - 141.97 after 95 % SO_2 capture by limestone injection or Coal - 141.97 after 30 % SO_2 capture by limestone injection	-
b)	Mg/Nm^3	858	<600	Complying with new emission standard while usage of Petcoke, ricehusk & Coal.
c)	Limestone Injection, TPD	-	@ Petcoke firing - 104 or @ Coal firing – 5.8	Limestone injection for control of SO_2 emissions complying with new emission norms
11.	Max. NOx in stack flue gases			
	Kg/Hr	Coal – 65.97	Fuel Mix - 65.97 or Coal -65.97 Or combination of petcoke, rice husk & coal	-
	Mg/Nm^3	300	300	Complying with new standard CFBC boiler will have Low Nox emissions
12.	Ash Generation			
	Total Ash, tpd	244	95.22 - with pet coke firing	Includes ash generated from lime injection

S. No.	Particulars	Existing Environmental Clearance (EC)	Proposed EC Amendment	Remarks
			Or 249.16 - with coal firing	
	Fly Ash generation (tpd)	159	62.30 with pet coke firing (2.128 ash from Petcoke firing and 60.16 bottom ash due to limestone injection) Or 162.35 with Coal firing (159 from coal firing and 3.35 bottom ash due to limestone injection	No change. 100% fly ash will be used in cement manufacturing process
	Bottom Ash generation (tpd)	85	32.92 (0.532 ash from Petcoke firing and 32.38 bottom ash due to limestone injection or 86.8 (85 from coal firing and 1.80 bottom ash due to limestone injection)	100% bottom ash will be reused as raw mix ingredient in cement manufacturing process
13.	Boiler stack height (M)	98 (single)	98 (single)	No Change. Stack height Requirement is 62 m as per CPCB norm. However the same stack height of 98 m will be maintained
14.	Particulate Matter emission (mg/Nm^3)	<50	<50	No Change High efficiency ESP (2 nos) provided

*Fuel quantity may vary depending upon the calorific value of fuel.

Overall Emissions Due To Use Of 100% Pet coke, rice husk in addition to Coal In Kiln Of Cement Plant And Boiler Of Captive Power Plant									
S.No	**Parameter**		**Existing Environmental Clearance (EC)**			**Proposed EC Amendment**			**Remark**
			Kiln	CPP	**Total**	Kiln	CPP	**Total**	
1	Air Emissions, Kg/hr	Particulate Matter	16.7	15.98	**32.68**	10.01	15.98	**25.99**	↓ decrease In overall emissions
		Sulphur Dioxide	9.32	202.97	**212.29**	9.32	*141.95	**151.27**	
		Oxides of Nitrogen	533.09	95.98	**629.06**	267.26	95.98	**363.24**	
			Kiln	CPP	Cumulative	Kiln	CPP	Cumulative	
2	Ground Level Concentrations (μg/m^3)	Particulate Matter	1.036	1.17	**2.18**	0.621	1.17	**1.77**	↓ decrease in ground level concentrations
		Sulphur Dioxide	0.578	14.9	**15.5**	0.578	10.43	**10.98**	
		Oxides of Nitrogen	33.1	7.05	**39.8**	16.66	7.05	**23.4**	

Note :↓ decrease ↑ increase

*Sulphur dioxide Control by limestone injection in CPP

3.0 NEED FOR USE OF PET COKE

Due to uncertainty in the availability of coal linkage and rising prices of imported coal, it is proposed to use petcoke, rice husk as much as possible in addition to coal depending upon its availability for which approval from MoEF&CC is being sought. The proposed fuel, i.e. Pet Coke is waste from the refinery and readily available in Indian market. For the above Kiln/CPP, the conversion to pet coke as an alternative fuel is envisaged due to the following reasons:

1) Petroleum coke (Pet coke) is a carbonaceous solid derived from oil refinery coke units or other cracking processes. The chemical composition of petroleum coke is mostly elementary Carbon (usually over the 85% C dry with sulphur content of about 8.5 % (max)) with high heating value and very little ash content (usually less than 1-2 %).
2) Petroleum coke is a fuel that has long been considered an ideal fuel for the circulating fluidized bed combustion (CFBC) technology.
3) Despite the low volatile content of pet coke, combustion efficiency is quite good in a circulating fluidized bed (CFBC) boiler, (at least 2.5% higher than that of Coal fired CFB).

4) Lower temperatures improve the emissions performance as well as reduce the potential for agglomeration and deposition. The recommended furnace design temperature should be typically in the range of 850 - 900°C. This will in-turn reduce the NOx emissions as well.
5) Compared to other low ash coals, pet coke has advantage in terms of bed material inventory. In spite of having low ash content, the bed material requirement is minimum, since limestone and its reacted products (gypsum) act as the bed material.
6) Use of Pet Coke in cement Kiln will facilitate use of sub-grade limestone to the optimum extent resulting in production of high quality clinker.

4.0 ENVIRONMENTAL BENEFITS OF USAGE OF PETCOKE

CEMENT PLANT

Use of Petcoke in the cement industry results in various environmental benefits listed below

- Petcoke is a refinery waste which is having a high calorific value. Usage of Petcoke at BCW provides waste disposal solution to the refinery thereby helps conserving virgin natural resources.
- In case of 100 % availability & usage of Petcoke there will be reduction of approx. 0.5 % of gypsum usage which will results in resources conservation.
- Low particulate matter and fugitive emission as the ash content in Petcoke is negligible.
- There will not be any change in Sulphur-di-oxide (SO_2) emissions from kiln as limestone is the main component of the kiln feed and sulphur in the fuel (Petcoke) gets absorbed in the process.
- Lowering CO2 emissions

CAPTIVE POWER PLANT

The pet coke based captive power plant will ensure supply of power at a competitive cost, providing greater flexibility and viability to the ACC Manufacturing operations in an environmentally responsive manner.

The project will result in following environmental and economic benefits:

1) Generation of power at a competitive cost compared to power generated by using imported coal.
2) Utilization of industrial waste thus resulting in fossil fuel conservation.
3) Limestone injection in Boiler will greatly minimize SO_2 emission from the stack (>95 % reduction and to meet new environmental norms of <600 mg/Nm^3).
4) Solid wastes viz. Fly Ash and Bottom Ash generated from the CPP will be reused/ recycled in the cement plant located within the premises.
5) Lowering CO_2 emissions

5.0 PROJECT DESCRIPTION:

Integrated Cement Manufacturing unit of BCW Cement is located at Cement Nagar, Bardol, Khaliapali, Bargarh, Odisha. It is a fully integrated cement plant supported with captive power plant and captive mining of limestone.

Fuel is used in the following areas of cement plant complex

a. Kiln of Cement Plant
b. Boiler of Captive Power plant

Presently fuel used is coal for which all clearances were obtained. Due to non availability of coal, it is now proposed to use pet coke, coal & rice husk as a fuel for the CPP& Kiln. The pet coke is proposed to be brought to site by rail/ road. In case of road transport, pet coke will be brought in high capacity covered trucks to avoid spillage.

The existing Circulating Fluidized Bed Combustion (CFBC) technology boilers in the CPP are capable of using wide variety of solid fuels and hence change of fuel to pet coke, coal & rice husk will not require any special construction or modification in the plant design. Pet coke requirement for the project (Kiln and CPP) will be about 0.207million TPA. It is proposed to inject limestone into the boiler to control SO_2 emission. The limestone requirement is about 0.038 million TPA.

5.1 CEMENT PLANT

BCW proposes to use petcoke due to uncertainty in the availability as well as rising prices of coal/imported coal. Use of petcokein

InLinecalciners (ILC) is viable as the kiln is already equipped with InLineCalciner (ILC).In-line calciners generally have lower NOx emissions than separate-line calciners (SLC), since all of the kiln exhaust gases must pass through the calciner. In an ILC, the fuel is injected into the kiln riser below where the tertiary air enters at the base of the calciner. This so-called reduction zone, designed for a particular gas retention time, has an oxygen deficient atmosphere that promotes NOx reduction.

The process of clinker production in kiln systems creates favourable conditions for use of pet coke due to high temperatures, long residence times, an oxidising atmosphere, alkaline environment, ash retention in clinker, and high thermal inertia which ensure that the fuel's organic part is destroyed and the inorganic part, including heavy metals is trapped and combined in the product.

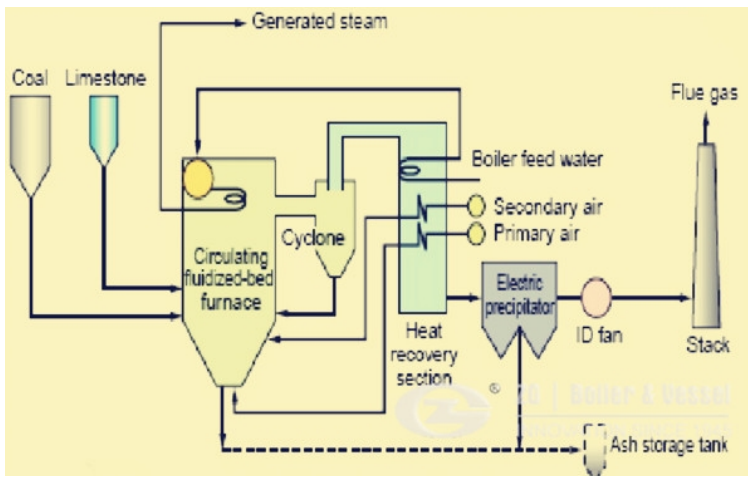
No additional machinery is required for firing of Petcoke in kiln.

6.2 CAPTIVE POWER PLANT

Process Description

CFBC Technology:

The depleting trend of coal quality and environmental considerations due to high sulphur and high ash content fuels, the technology of circulating fluidized bed combustion (CFBC) invented in 1980s has become popular over the time. CFBC boiler consists of a boiler and a high-temperature cyclone as a solid separation device. A coarse fluidizing medium and char in the flue gas are collected by the high temperature cyclone and recycled to the boiler. Recycling maintains the bed height and increases the denigration efficiency. To increase the thermal efficiency, a pre-heater for the fluidizing air and combustion air, and a boiler feed water heater, are installed. In CFBC boilers, combustion takes place at temperatures in the range of 800-900°C resulting in reduced NOx emissions compared with pulverized coal fired units or any other coal fired technologies. SO_2 emission is reduced by injection of limestone in the combustion chamber. Circulating beds use a higher fluidizing velocity, so the particles are constantly held in the flue gases, and pass through the main combustion chamber and enter into a cyclone, from where the larger particles are extracted and returned to the combustion chamber. Combustion conditions are relatively uniform through the combustor, although the bed is somewhat denser near the bottom of the combustion chamber. There is a great deal of mixing, and residence time during one pass is very short. The bed material is preferred either as crushed refractory or from the fuel ash or as sand in some cases. Due to the large heat capacity of the bed, combustion is stable and no supporting fuels are required, provided the fuel heating value is sufficient to raise the combustion air and the fuel itself above its ignition temperature. The intense turbulence ensures good mixing and combustion of the fuel. The schematic of a CFBC boiler is shown below



Limestone Feed and Control Mechanism

Sulphur capture in CFBC boilers happens by injecting Limestone along with fuel. The fuel and Lime mixture enters into combustion chamber through multiple feed points located in furnace front close to the bottom primary zone. Limestone undergoes decomposition by taking heat from the hot bed material (endothermic) and converts into Calcium Oxide (CaO).This process is called Calcination. The calcinedLimestone being porous in nature gets entrained in flue gas and enters the top section of furnace where the mixture of Oxygen and Sulphur Dioxide reacts with Calcium Oxide and converts into Calcium Sulfate (CaSO4).This Process is called Sulfation. This process is an exothermic reaction. Thus, the Limestone converts gaseous SO_2 emission to solid Calcium Sulfate and gets removed from the system. Attributing higher particle residence time and recirculation, the

Sulphur capture efficiency in CFBC boilers can be achieved to almost 95%. The amount of limestone that is required for a given amount of fuel depends on the sulphur content of fuel. An increase in sulphur dioxide emissions will necessitate an increase in the amount of limestone that is required for a given fuel flow to the furnace. The limestone demand is a function of the main fuel flow. An increase in fuel flow demand will result in a corresponding increase in the limestone demand to provide the demand signal to the Limestone Variable Rotary Feeder.

6.0 FUEL-REQUIREMENT, QUALITY AVAILABILITY & TRANSPORTATION:

It is envisaged that pet coke required for the project will be transported through rail/ road. During road transport pet coke will be brought in closed trucks. Limestone available inside the plant will be used.

PET COKE QUANTITY:

Considering pet coke with gross calorific value (GCV) of 8000kCal/kg and plant load factor of 100%, the annual pet coke requirement for CPP works out to be about 0.110Million Tonnes and 0.097 Million Tonnes for Cement Plant.

FUEL QUALITY (PET COKE):

Pet coke for the project will be available either from Indian refineries/imported. During road transport, pet coke will be brought in high capacity covered trucks. The proximate and ultimate analysis of pet coke to be used for the captive power plant& Kiln, are as follows:

Heating Values	
Calorific Value	8000 kcal/kg
Ultimate Analysis (weight %)	
Moisture	4.50
Ash	0.84
Carbon	79.00
Hydrogen	3.21
Nitrogen	1.37

Sulphur	6.00
Oxygen	1.69
Proximate Analysis (weight %)	
Moisture	4.5
Ash	0.84
Volatile Matter	10.60
Fixed Carbon	80.30

Source :ACC Ltd

Because of the extremely low ash (<1%) and high sulphur content of pet coke (6%), limestone is used in the majority of bed materials of the CFBC boilers using pet coke. Limestone sizing is critical not only for efficient sulphurcapture but also for effective fluidization and fuel mixing thereby uniform temperatures and heat transfer is attained. Limestone inside the plant will be used. Limestone of approx. 45% CaO content will be used for CPP for desulphurization.

PET COKE HANDLING PLANT:

The pet coke handling will be done in the same system designed for coal.

RICE HUSK

Firing of rice husk in fluidized bed boilers will have high efficiency of about 75%. Complete Combustion, quick start-up and low pollution are better with rice husk firing. Rice husks usage in boiler will have the following advantages

- Rice husk is renewable source of energy with neutral carbon resulting in reduction of the emission of greenhouse gases.
- Rice husk results in reduction of emissions of sulfur and NOx when compared to other fossil fuels

7.0 ENVIRONMENTAL IMPACTS

Environmental impacts due to use of pet coke in the Cement plant and Captive power plant has been worked out and presented below under each environmental component.

There will be no change in water and wastewater components of the plant due to use of Pet coke & rice husk along with coal

7.1AIR ENVIRONMENT

The emission details along with emission parameters for Coal and Petcoke are given below.

EMISSION DETAILS (EC OBTAINED)

Location	Height	Temp-	Dia-	Velocity of flue gas	Flow rate m^3/hr	Emissions from stacks (gm/sec) (Max.)		
	M	^oC	M	M/sec		PM	SO_2	NOx
CEMENT PLANT								
*Raw Mill/Kiln	113.5	130	3.4	14	452000	4.64	2.59	148.08
CAPTIVE POWER PLANT								
+CPP Boiler stack	98	130	2.6	17	320000	4.44	56.38	26.66

*emissions are based on operating values PM = 50 mg/Nm^3, SO_2 = 28 mg/Nm^3 and NOx 1595 mg/Nm^3 in case of kiln

+ emissions are based on PM=50 mg/Nm^3 , SO_2 = 634 mg/Nm^3 and NOx 300 mg/Nm^3 in case of captive power plant

EMISSION DETAILS (EC REQUESTED)

Location	Height	Temp-erature	Dia-meter	Velocity of flue gas	Flow rate Nm^3/hr	emissions from stacks (gm/sec)		
	M	^oC	M	M/sec		PM	SO_2	NOx
CEMENT PLANT								
*Raw Mill/Kiln	113	130	3.4	14	452000	2.78	2.59	74.24
CAPTIVE POWER PLANT								
+CPP Boiler stack – fired with 100 % petcoke	98	130	2.6	17	320000	4.44	39.43	26.66

#petcoke or coal will be fired at any given time. Control of SO2 will be by lime injection in boiler for both the fuels

*emissions are based on PM = 30mg/Nm3, SO2 = 100 mg/Nm^3 and NOx 800 mg/Nm^3 in case of kiln

+ emissions are based on PM=50 mg/Nm3 , SO2 = 600 mg/Nm3 and NOx 300 mg/Nm3 in case of CPP

The emission load in terms of Kg/hr (both from cement plant kiln and captive power plant is given below :

Kg/hr	**EC granted**			**EC requested**			**Remark**
	Kiln	CPP	Total	Kiln	CPP	Total	
Particulate Matter	16.7	15.98	32.68	10.01	15.98	25.99	↓ decrease In overall emissions
Sulphur Dioxide	9.32	202.97	212.29	9.32	*141.95	151.27	
Oxides of Nitrogen	533.09	95.98	629.06	267.26	95.98	363.24	

*Sulphur dioxide Control by limestone injection in CPP

GROUNDLEVEL CONCENTRATION

The ground level concentration due use of petcoke in kiln of cement plant and CPPcomputed using AERMOD model (EPA recommended model) is given below:

				EC granted			**EC requested**
		Kiln	CPP	Cumulative	Kiln	CPP	Cumulative
Ground Level Concentrations ($\mu g/m^3$)	Particulate Matter	1.036	1.17	**2.18**	0.621	1.17	**1.77**
	Sulphur Dioxide	0.578	14.9	**15.5**	0.578	10.43	**10.98**
	Oxides of Nitrogen	33.1	7.05	**39.8**	16.66	7.05	**23.4**

Predicted ground level concentration of PM_{10}, SO_2 and NO_x due to use of petcoke\coal\rice husk in kiln of cement plant and boiler of captive power plant are shown in **Fig - 1**to **Fig – 3.** 50 High 24-hourly average ground level concentrations of PM_{10}, SO_2 and NO_x are given in **Table – 1**to **Table – 3.**

AIR POLLUTION CONTROL MEASURES

The change in pollution control equipment due to use of pet coke, rice husk in kiln and captive power plant are given below:

POLLUTION CONTROL EQUIPMENT

		EC Granted	EC Requested	Remarks
Sl. No.	**Location / Unit**	**Type of Equipment**	**Type of Equipment**	
Control of Particulate Emissions				
1	Kiln/Rawmill	Bag house – 1 no	Bag house – 1 no	No change
2	Boiler – CPP	ESP – 2 nos	ESP – 2 nos	No change
Control of SO_2				
1	Kiln/Raw mill	Absorption in Kiln	Absorption in kiln	Optimization of raw mix and process parameters will be done for efficient absorption of SO_2 in kiln atmosphere.
2	Boiler – CPP	-	Limestone injection at CFBC boiler	
Control of NOx emissions				
1	Kiln/raw mill	Low NOx burner and Low NOx Calciner	Low NOx burner and Low NOx Calciner	Calciner Modification, ProcessOptimization& BurnerModification
2	Boiler – CPP	CFBC Boiler	CFBC Boiler	Low NOx emissions. Usage of biomass

Note: Results of Pet Coke Trial Run conducted by NCCBM at 33 Kilns showed that there is no increase in SO_2, NOx and PM in kiln while the Pet Coke was used.

➲ CONTROL OF PARTICULATE MATTER

Cement plant: Pollution control equipment for control of particulate emission specified above are designed for meeting outlet emissions below 30mg/Nm^3.

Captive Power plant: Due to the very low ash content in Petcoke, there will be low particulate matter emission in captive power plant and the outlet emissions will be well below 50 mg/Nm^3

➲ CONTROL OF SULPHUR DIOXIDE

Cement Plant

The combustion zone of the kiln with the presence of high lime dust acts as a scrubber combining to form calcium sulfate preventing much of the potential SO_2 from the emission gas stream.

The combustion of Sulfur: $S + O_2 \rightarrow SO_2$
The formation of Calcium Sulfate: $CaO + SO_2 + ½ O_2 \rightarrow CaSO_4$

Captive Power Plant

CFBC technology is ideal for pet coke firing because its long burning process ensures complete combustion of the low volatile pet coke. The technology also captures a large amount of Pet Coke's sulphur during the combustion process. The vigorous mixing of the fuel, limestone and ash particles during the low-temperature fluidized process allows the CFBC to cleanly and efficiently burn almost any combustible material, while minimizing the formation of NOx and optimising the capture of SO2 as the fuel burns. The combustion temperature is well below the melting point of the fuel's ash, which allows the CFBC to minimize the corrosion and fouling issues experienced in conventional boilers.

➲ CONTROL OF OXIDES OF NITROGEN

Cement Plant: The kiln is equipped with InLineCalciner (ILC).In-line calciners generally have lower NOx emissions than separate-line calciners, since all of the kiln exhaust gases must pass through the calciner. In an ILC, the fuel is injected into the kiln riser below where the tertiary air enters at the base of the calciner. This so-called reduction zone, designed for a particular gas retention time, has an oxygen deficient atmosphere that promotes NOx reduction.

The kiln at Bargarh is equipped with 6 stage preheater along with ILC calciner. The following primary measures are under implementation and expected Nox emissions will be within the limit applicable for ILC kiln i.e 800 mg/Nm^3 as per the new MoEF&CC notification.

Expected reduction potential of various measures is given below:

S.no	**Primary Measures**	% Reduction of Nox Emissions
1	Calciner Modification	10-30
2	Process Optimization*	10-30
3	Burner Modification	10-30

*Process optimization includes primary measures like addition of mineralizers, raw meal split, raw meal curtain, fuel split, air split which helps in NOx reduction.

Captive Power Plant: NOx emissions are low in CFBC Boilers. Additionally, to reduce NOx to an extent of 20 %, process optimization and use of Biomass will be done.

8.2SOLID WASTE GENERATION

The solid waste generation is mainly ash from the power plant. Maximum ash generation is 249.15tpd when coal is burnt (from fuel ash and limestone injection). The maximum ash generation will reduce to 94.66 TPD (from fuel ash and limestone injection) with petcoke firing. Only dry ash handling system is adopted and the ash is stored in silos. Transportation of Ash in dry form from the hoppers to storage silos is done through pneumatic conveying. 100% ash will be utilized for manufacturing of Portland Pozzolana Cement (PPC). All the flyash & bottom ash generated will be used in cement manufacturing.

SOLID WASTE GENERATION (T/DAY)

	EC Granted	**EC Requested**	**utilization**
FROM BOILER			
Fuel	Coal	Petcoke Or Coal	
Total Ash (tpd)	244	95.22 - with pet coke firing Or 249.16 - with coal firing	Total ash will be utilized in cement manufacturing process
Fly Ash generation (tpd)	159	62.30 with pet coke firing Or 162.35 with Coal firing	
Bottom Ash generation (tpd)	85	32.92 with pet coke firing or 86.8 with Coal firing	

9.0 CONCLUSION

ACC – BCW proposes to obtain Amendment in EC for use of petcoke and rice husk in addition to coal as alternative fuels in Kiln of cement plant and Boiler of captive power plant.

Use of Petcoke in the cement industry results in various environmental benefits listed below

1) Generation of power at a competitive cost compared to power generated by using imported coal.
2) Utilization of industrial waste thus resulting in fossil fuel conservation.
3) Limestone injection in Boiler will greatly minimize SO_2 emission from the stack (>95 % reduction and to meet new environmental norms of <600 mg/Nm^3).
4) Solid wastes viz. Fly Ash and Bottom Ash generated from the CPP will be reused/ recycled in the cement plant located within the premises.
5) Lowering CO2 emissions

Use of Pet coke will not result in increase of $SO_2$and due to complete absorption by the limestone in Kiln. CFBC technology adopted enables use of pet coke in the boiler and injection of limestone which controls the sulphur dioxide emission by 95 % meeting outlet concentration of 600 mg/Nm^3.

In CFBC boilers, combustion takes place at temperatures in the range of 800-900°C resulting in reduced NOx emissions compared with pulverized coal fired units or any other coal fired technologies. Infact, a CFBC boiler, due to low temp combustion, doesn't allow formation of thermal NOx which is the largest contributor of overall NOx emissions.Additionally process optimization and biomass will be used to control NOx emissions

There will be decrease in pollution load with pet coke usage as lime injection in boiler is proposed for capturing the sulphur dioxide. The comparison statement of pollution load and corresponding Groundlevel concentrations are shown below:

Overall Emissions Due To Use Of 100% Pet coke, rice husk in addition to Coal In Kiln Of Cement Plant And Boiler Of Captive Power Plant

Parameter		**Existing Environmental Clearance (EC)**			**Proposed EC Amendment**			**Remark**
		Kiln	CPP	Total	Kiln	CPP	Total	
Air Emissions, Kg/hr	Particulate Matter	16.7	15.98	32.68	10.01	15.98	25.99	↓ decrease In overall emissions
	*Sulphur Dioxide	9.32	202.97	212.29	9.32	141.95	151.27	
	Oxides of Nitrogen	533.09	95.98	629.06	267.26	95.98	363.24	

Ground Level Concentrations (ug/m^3)

	Kiln	CPP	Cumulative	Kiln	CPP	Cumulative	
Particulate Matter	1.036	1.17	2.18	0.621	1.17	1.17	↓ decrease in ground level concentrations
Sulphur Dioxide	0.578	14.9	15.5	0.578	10.43	10.98	
Oxides of Nitrogen	33.1	7.05	39.8	16.66	7.05	23.4	

Note :↓ decrease ↑ increase

*Sulphur dioxide Control by limestone injection in CPP

There will be no change in water and wastewater components of the plant due to use of Pet coke, rice husk in addition to coal.

Solid waste generated from limestone injection will be totally used in the cement plant

Amendment in EC proposal facilitates use of petcoke, coal & rice husk in Kiln and Boiler. Use of Pet Coke in cement Kiln facilitates use of sub-grade limestone to the optimum extent resulting in production of high quality clinker

In view of the above, ACC-BCW requests MOEF&CC to consider the above aspects and issue the amendment in Environmental clearance for use of Petcoke and Rice Husk (in proportion based on the availability) in addition to Coal in Cement Plant and Captive Power Plant.

* * *

Table – 1

Predicted 50 high 24-hourly Average Ground Level Concentration

Of Particulate Matter Due To Use Of Pet Coke In Kiln Of Cement Plant And Boiler Of Captive Power Plant

RANK	CONC	(YYMMDDHH)	AT	RECEPTOR (XR,YR) OF (UTM COORDINATES)	TYPE	RANK	CONC	(YYMMDDHH)	AT	RECEPTOR (XR,YR) OF (UTM COORDINATES)	TYPE
1	1.77124c	16052024	AT	(770910.16, 2365375.25)	GP	26	1.42582c	16052024	AT	(771380.01, 2365046.26)	GP
2	1.76596c	16052024	AT	(770947.00, 2365296.26)	GP	27	1.41176c	16050524	AT	(770910.16, 2365717.27)	GP
3	1.73441c	16052024	AT	(770887.61, 2365459.44)	GP	28	1.40201c	16052724	AT	(771813.02, 2365796.26)	GP
4	1.72190c	16052024	AT	(770996.99, 2365224.87)	GP	29	1.39840c	16050524	AT	(771380.01, 2365046.26)	GP
5	1.66076c	16052024	AT	(770880.01, 2365546.26)	GP	30	1.39528c	16052024	AT	(771466.83, 2365053.86)	GP
6	1.65127c	16052024	AT	(771058.62, 2365163.24)	GP	31	1.38478c	16052024	AT	(770996.99, 2365867.65)	GP
7	1.57373c	16052024	AT	(771130.01, 2365113.25)	GP	32	1.37979c	16050524	AT	(770947.00, 2365796.26)	GP
8	1.57054c	16052024	AT	(770887.61, 2365633.08)	GP	33	1.36799c	16050524	AT	(771466.83, 2365053.86)	GP
9	1.52164c	16052724	AT	(771701.40, 2365929.28)	GP	34	1.36591c	16052024	AT	(771551.02, 2365076.41)	GP
10	1.50892c	16052024	AT	(771209.00, 2365076.41)	GP	35	1.34707c	16050524	AT	(770996.99, 2365867.65)	GP
11	1.50138c	16050524	AT	(770947.00, 2365296.26)	GP	36	1.34660c	16052024	AT	(771058.62, 2365929.28)	GP
12	1.50034c	16052724	AT	(771763.03, 2365867.65)	GP	37	1.34651c	16051624	AT	(771630.01, 2365979.27)	GP
13	1.49935c	16050524	AT	(770996.99, 2365224.87)	GP	38	1.34496c	16051624	AT	(771551.02, 2366016.11)	GP
14	1.49572c	16050524	AT	(770910.16, 2365375.25)	GP	39	1.33686c	16052024	AT	(771630.01, 2365113.25)	GP
15	1.48999c	16050524	AT	(771058.62, 2365163.24)	GP	40	1.33668c	16050524	AT	(771551.02, 2365076.41)	GP
16	1.48738c	16052024	AT	(770910.16, 2365717.27)	GP	41	1.32972c	16050524	AT	(771380.01, 2366046.26)	GP
17	1.48310c	16050524	AT	(770887.61, 2365459.44)	GP	42	1.32870c	16050524	AT	(771293.19, 2366038.66)	GP
18	1.47411c	16050524	AT	(771130.01, 2365113.25)	GP	43	1.32196c	16050524	AT	(771058.62, 2365929.28)	GP
19	1.46431c	16050524	AT	(770880.01, 2365546.26)	GP	44	1.32026c	16050524	AT	(771209.00, 2366016.11)	GP
20	1.46278c	16052024	AT	(771293.19, 2365053.86)	GP	45	1.31817c	16050524	AT	(771466.83, 2366038.66)	GP
21	1.45332c	16052724	AT	(771630.01, 2365979.27)	GP	46	1.31424c	16050524	AT	(771130.01, 2365979.27)	GP
22	1.45270c	16050524	AT	(771209.00, 2365076.41)	GP	47	1.31142c	16052024	AT	(771130.01, 2365979.27)	GP
23	1.44020c	16050524	AT	(770887.61, 2365633.08)	GP	48	1.30897c	16052024	AT	(771701.40, 2365163.24)	GP
24	1.42766c	16052024	AT	(770947.00, 2365796.26)	GP	49	1.30555c	16050524	AT	(771630.01, 2365113.25)	GP
25	1.42697c	16050524	AT	(771293.19, 2365053.86)	GP	50	1.30477c	16052724	AT	(771551.02, 2366016.11)	GP

Table – 2

Predicted 50 high 24-hourly Average Ground Level Concentration

Of Sulphur Dioxide Due To Use Of Pet CokeIn Kiln Of Cement Plant And Boiler Of Captive Power Plant

RANK	CONC	(YYMMDDHH)	AT	RECEPTOR (XR,YR) OF (UTM COORDINATES)	TYPE	RANK	CONC	(YYMMDDHH)	AT	RECEPTOR (XR,YR) OF (UTM COORDINATES)	TYPE
1	10.98278c	16052024	AT	(770947.00, 2365296.26)	GP	26	8.85206c	16050524	AT	(771466.83, 2365053.86)	GP
2	10.87438c	16052024	AT	(770996.99, 2365224.87)	GP	27	8.84776c	16051624	AT	(771630.01, 2365979.27)	GP
3	10.83875c	16052024	AT	(770910.16, 2365375.25)	GP	28	8.82182c	16052024	AT	(770910.16, 2365717.27)	GP
4	10.54045c	16052024	AT	(771058.62, 2365163.24)	GP	29	8.82013c	16050524	AT	(770887.61, 2365459.44)	GP
5	10.46791c	16052024	AT	(770887.61, 2365459.44)	GP	30	8.80758c	16052024	AT	(771630.01, 2365113.25)	GP
6	10.09537c	16052024	AT	(771130.01, 2365113.25)	GP	31	8.68710c	16050524	AT	(771551.02, 2365076.41)	GP
7	9.96640c	16052724	AT	(771763.03, 2365867.65)	GP	32	8.65843c	16051624	AT	(771551.02, 2366016.11)	GP
8	9.92972c	16052024	AT	(770880.01, 2365546.26)	GP	33	8.65263c	16050524	AT	(770880.01, 2365546.26)	GP
9	9.90623c	16052724	AT	(771701.40, 2365929.28)	GP	34	8.63314c	16052024	AT	(771701.40, 2365163.24)	GP
10	9.71964c	16052024	AT	(771209.00, 2365076.41)	GP	35	8.58203c	16051624	AT	(771701.40, 2365929.28)	GP
11	9.47561c	16052024	AT	(771293.19, 2365053.86)	GP	36	8.50836c	16050524	AT	(771630.01, 2365113.25)	GP
12	9.44434c	16052724	AT	(771813.02, 2365796.26)	GP	37	8.50377c	16052724	AT	(771849.86, 2365717.27)	GP
13	9.33606c	16052024	AT	(770887.61, 2365633.08)	GP	38	8.47747c	16052024	AT	(770947.00, 2365796.26)	GP
14	9.28530c	16052024	AT	(771380.01, 2365046.26)	GP	39	8.47323c	16050524	AT	(770887.61, 2365633.08)	GP
15	9.22245c	16050524	AT	(771130.01, 2365113.25)	GP	40	8.46005c	16052024	AT	(771763.03, 2365224.87)	GP
16	9.21839c	16050524	AT	(771058.62, 2365163.24)	GP	41	8.32347c	16050524	AT	(771701.40, 2365163.24)	GP
17	9.21785c	16052724	AT	(771630.01, 2365979.27)	GP	42	8.29457c	16052024	AT	(771813.02, 2365296.26)	GP
18	9.18450c	16050524	AT	(771209.00, 2365076.41)	GP	43	8.28906c	16050524	AT	(770910.16, 2365717.27)	GP
19	9.17262c	16050524	AT	(770996.99, 2365224.87)	GP	44	8.27435c	16052024	AT	(770996.99, 2365867.65)	GP
20	9.13378c	16052024	AT	(771466.83, 2365053.86)	GP	45	8.18125c	16050524	AT	(771466.83, 2366038.66)	GP
21	9.10685c	16050524	AT	(771293.19, 2365053.86)	GP	46	8.16144c	16050524	AT	(771380.01, 2366046.26)	GP
22	9.08784c	16050524	AT	(770947.00, 2365296.26)	GP	47	8.13979c	16052024	AT	(771849.86, 2365375.25)	GP
23	8.99427c	16050524	AT	(771380.01, 2365046.26)	GP	48	8.13936c	16050524	AT	(771763.03, 2365224.87)	GP
24	8.97686c	16052024	AT	(771551.02, 2365076.41)	GP	49	8.11568c	16050524	AT	(771551.02, 2366016.11)	GP
25	8.96807c	16050524	AT	(770910.16, 2365375.25)	GP	50	8.11492c	16052024	AT	(771058.62, 2365929.28)	GP

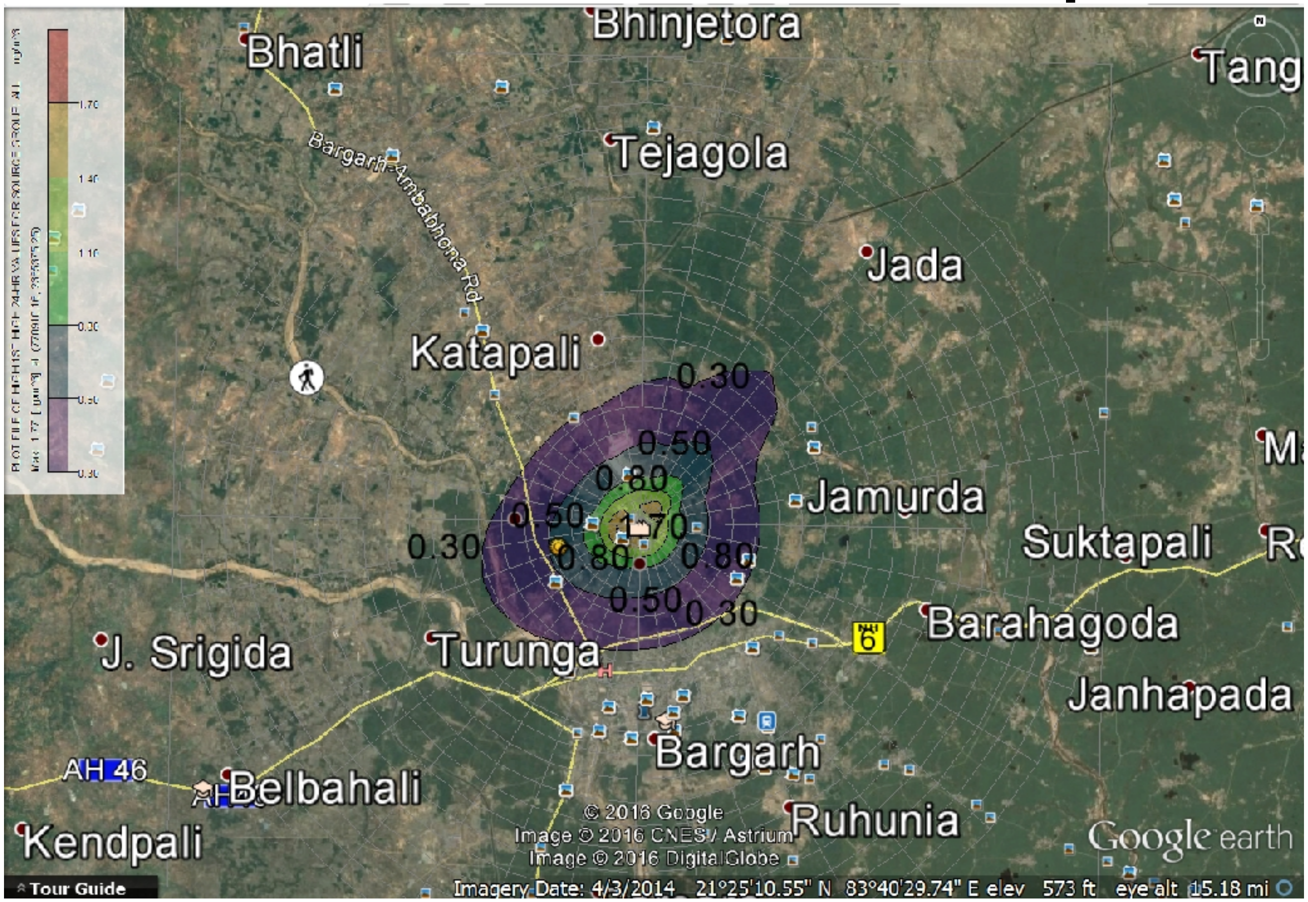
Table – 3

Predicted 50 high 24-hourly Average Ground Level Concentration

Of Oxides of Nitrogen Due To Use Of Pet CokeIn Kiln Of Cement Plant And Boiler Of Captive Power Plant

RANK	CONC	(YYMMDDHH)	AT	RECEPTOR (XR,YR) OF (UTM COORDINATES)	TYPE	RANK	CONC	(YYMMDDHH)	AT	RECEPTOR (XR,YR) OF (UTM COORDINATES)	TYPE
1	23.37232c	16052024	AT	(770910.16, 2365375.25)	GP	26	18.33208c	16052724	AT	(771630.01, 2365979.27)	GP
2	23.26532c	16052024	AT	(770887.61, 2365459.44)	GP	27	18.12367c	16050524	AT	(771058.62, 2365929.28)	GP
3	22.84337c	16052024	AT	(770947.00, 2365296.26)	GP	28	18.09533c	16052024	AT	(771058.62, 2365929.28)	GP
4	22.52125c	16052024	AT	(770880.01, 2365546.26)	GP	29	17.93642c	16052024	AT	(771293.19, 2365053.86)	GP
5	21.84228c	16052024	AT	(770996.99, 2365224.87)	GP	30	17.88695c	16050524	AT	(771130.01, 2365979.27)	GP
6	21.43913c	16052024	AT	(770887.61, 2365633.08)	GP	31	17.85350c	16050524	AT	(771293.19, 2365053.86)	GP
7	20.65439c	16052024	AT	(771058.62, 2365163.24)	GP	32	17.79726c	16050524	AT	(771209.00, 2366016.11)	GP
8	20.35555c	16052024	AT	(770910.16, 2365717.27)	GP	33	17.75256c	16052724	AT	(771763.03, 2365867.65)	GP
9	20.23550c	16050524	AT	(770887.61, 2365459.44)	GP	34	17.70023c	16050524	AT	(771293.19, 2366038.66)	GP
10	20.21777c	16050524	AT	(770910.16, 2365375.25)	GP	35	17.48268c	16050524	AT	(771380.01, 2366046.26)	GP
11	20.12420c	16050524	AT	(770880.01, 2365546.26)	GP	36	17.44201c	16052024	AT	(771130.01, 2365979.27)	GP
12	20.07083c	16050524	AT	(770947.00, 2365296.26)	GP	37	17.35539c	16052024	AT	(771380.01, 2365046.26)	GP
13	19.88907c	16050524	AT	(770887.61, 2365633.08)	GP	38	17.31451c	16050524	AT	(771380.01, 2365046.26)	GP
14	19.79085c	16050524	AT	(770996.99, 2365224.87)	GP	39	17.11834c	16052724	AT	(771551.02, 2366016.11)	GP
15	19.55464c	16052024	AT	(771130.01, 2365113.25)	GP	40	17.09436c	16050524	AT	(771466.83, 2366038.66)	GP
16	19.54027c	16050524	AT	(770910.16, 2365717.27)	GP	41	16.86014c	16052024	AT	(771466.83, 2365053.86)	GP
17	19.51266c	16052024	AT	(770947.00, 2365796.26)	GP	42	16.84924c	16052024	AT	(771209.00, 2366016.11)	GP
18	19.39904c	16050524	AT	(771058.62, 2365163.24)	GP	43	16.79902c	16050524	AT	(771466.83, 2365053.86)	GP
19	19.08340c	16050524	AT	(770947.00, 2365796.26)	GP	44	16.63233c	16051624	AT	(771551.02, 2366016.11)	GP
20	18.92572c	16050524	AT	(771130.01, 2365113.25)	GP	45	16.55653c	16050524	AT	(771551.02, 2366016.11)	GP
21	18.79238c	16052024	AT	(770996.99, 2365867.65)	GP	46	16.41317c	16052024	AT	(771551.02, 2365076.41)	GP
22	18.64495c	16052024	AT	(771209.00, 2365076.41)	GP	47	16.32749c	16052024	AT	(771293.19, 2366038.66)	GP
23	18.56767c	16050524	AT	(770996.99, 2365867.65)	GP	48	16.32199c	16051624	AT	(771466.83, 2366038.66)	GP
24	18.52980c	16052724	AT	(771701.40, 2365929.28)	GP	49	16.31642c	16050524	AT	(771551.02, 2365076.41)	GP
25	18.40075c	16050524	AT	(771209.00, 2365076.41)	GP	50	16.24765c	16052724	AT	(771813.02, 2365796.26)	GP

Fig – 1
Predicted Ground Level Concentration
Of Particulate Matter Due To Use Of Pet Coke
In Kiln Of Cement Plant And Boiler Of Captive Power Plant



WIND ROSE

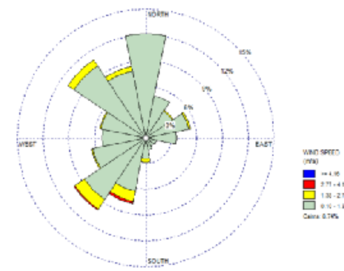


Fig – 2
Predicted Ground Level Concentration
Of Sulphur Dioxide Due To Use Of Pet Coke
In Kiln Of Cement Plant And Boiler Of Captive Power Plant

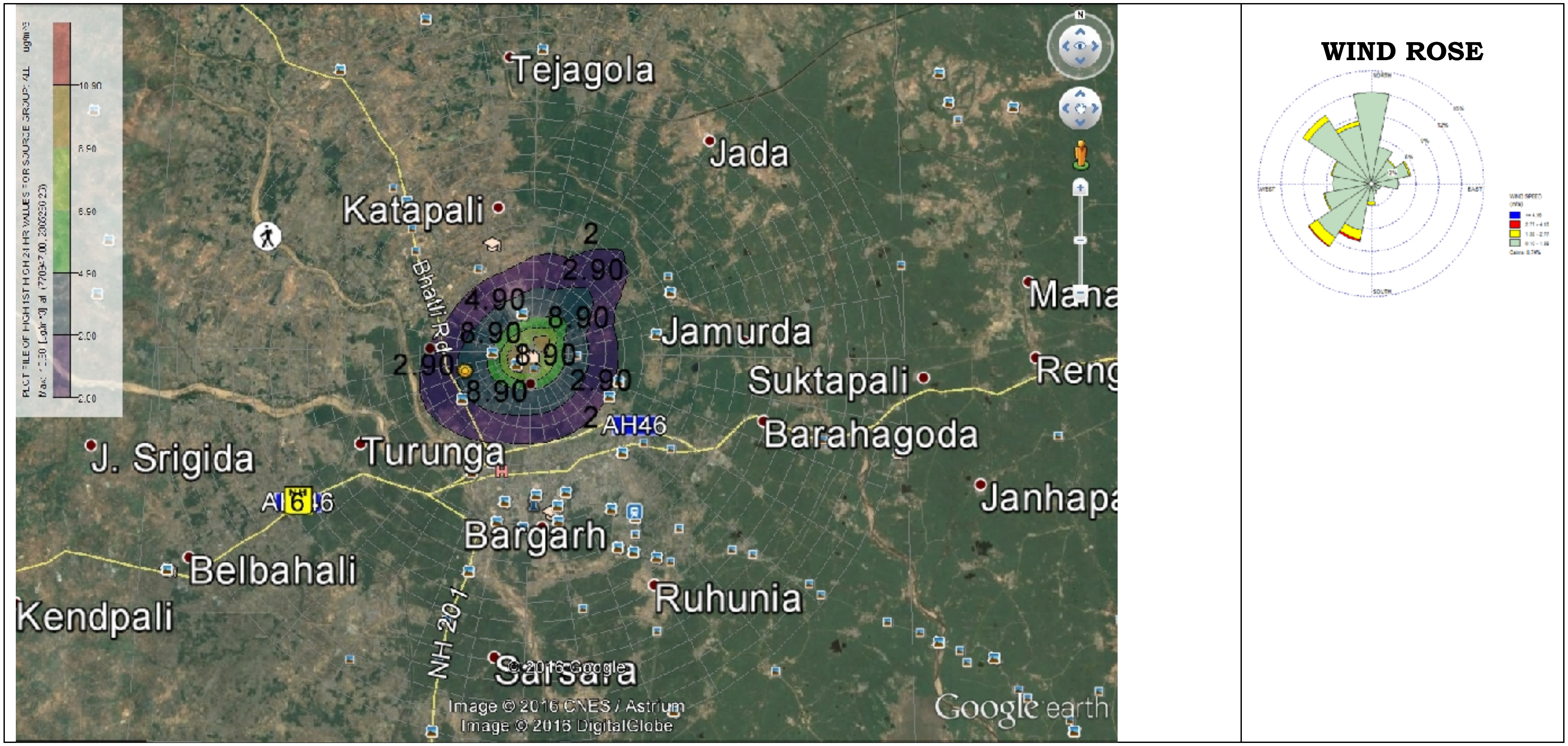


Fig – 3
Predicted Ground Level Concentration
Of Oxides of Nitrogen Due To Use Of Pet Coke
In Kiln Of Cement Plant And Boiler Of Captive Power Plant