PRE FEASIBILITY REPORT

FOR

SINGRAULI SUPER THERMAL POWER PROJECT
STAGE-III (2X660 MW)

NTPC Limited

(A Government of India Enterprise)

ENVIRONMENTAL ENGINEERING DEPARTMENT

Engineering Office Complex,
Sector -24, Noida,
U.P.-201 301

October, 2016

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Vicinity map of the project is shown in Exhibit-1.

The major components of the project are located between the following longitudes and latitudes:
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Plant Area: 660.0 Acres
Colony Area: 683.0 Acres
MGR: 179.22 Acres
Discharge Canal: 223.66 Acres
Ash Disposal Area 1516.58 Acres</td></tr>
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	R&R & Labour colony: 180.0 Acres Hill Park & Green belt: 967.97 Acres Approach Road: 81.0 Acres The main plant of Stage-III (2x660MW) shall be accommodated within existing main plant area. For ash disposal approximately 330 acres of additional land is required, for which various alternatives are being considered, such as mine void filling, acquisition of additional land or use of the township area after relocation of township.
Water Requirement and Availability:	The project, as per the MOEF&CC Notification dated 07.12.2015will need about 33 cusec of water. Water for Singrauli STPP, Stage-I and II is presently being drawn from Rihand reservoir and the plant is operating in open cycle CW system. However, Stage-III of the project shall have closed cycle cooling system with cooling towers in line with MOEF&CC Notification dated 07.12.2015. Makeup water for Stage-III is proposed to be drawn from the discharge channel of Stage-II. Clearance shall be taken from concerned authorities for the required quantity of water for Singrauli Stage-III (2x660MW).
Fuel Requirement:	Coal requirement for Singrauli STPP, Stage-III is estimated to be 6.5 MTPA. Presently coal to Singrauli STPP is being sourced from Jayant coal mines, which are at about 7 km distance and coal is transported by MGR system. NTPC proposes to decommission Stage-I units (5x200 MW) based on sub-critical technology after commissioning of Stage-III units (2x660 MW) based on super critical technology. NTPC shall request Ministry of Coal to transfer the coal linkage of existing units to the new units under Coal Linkage Transfer Policy.
Environmental Setting of the Project	Singrauli STPP-Stage-I & II with capacity of 2000 MW are under operation and regular monitoring of the air and water quality is being carried out and reports are submitted to State pollution control Board. The present expansion is proposed on the land which has been acquired during Stage I & II of Singrauli STPP which conforms to the siting criteria for thermal power plants. No Wildlife Sanctuaries/ National Parks or any ecological sensitive area of national importance, Protected/ Reserve Forests exist within 15 km. radius from Singrauli STPP. No archaeological monument of national importance & defence installations exist within 15 km. radius of the Singrauli STPP. However, Inter-state boundary of UP and MP exists adjacent to the project on Western side. Terms of Reference for Singrauli STPP, Stage-III (1x500 MW) was accorded by MOEF&CC vide letter dated 25.05.2009. Based on TOR, an EIA Study was undertaken and Public Hearing was held. However, the application for environmental clearance could not be processed due to non-availability of firm coal linkage and non-conductance of Public Hearing in Madhya Pradesh (required due to proposed location of ash

	dyke in Madhya Pradesh).
Cost of the Project:	The estimated cost of the project including the cost of FGD and NOx control systems as required under MOEF&CC Notification dated 07.12.2015 would be Rs. 7 Crores per MW, i.e. Rs. 9,240 Crores. However, the detailed cost shall be worked out during detailed Feasibility Study.

2.0 Introduction of the Project & Background Information

2.1 Identification of Project & Project Proponent

Singrauli STPP was set up by NTPC Limited as a pit head coal based super thermal power plant. The environmental clearance for the project was accorded by the then Department of Science and Technology vide letter dated 17.01.1977. The project was commissioned in two stages comprising of five units of 200 MW each under Stage-I and two units of 500 MW each under Stage-II. The First unit of 200 MW capacity was commissioned during February, 1982 and last unit of 500 MW capacity was commissioned during November, 1987. Environmental clearances for the S-1 and S-2 dykes of the project were accorded by MOEF vide letters no. J-13011/32/92-IA.II(T) dated 13.03.2000 and 27.10.2008 respectively.

Presently, Singrauli Super Thermal Power Station (SSTPS), Stage-I & II (2000 MW) is under commercial operation. In addition, the project has two projects of renewable energy within its

- A 15 MW Solar Photo Voltaic (SPV) based project in the MGR loading bulb at the mine end, at about 15 km. from power plant boundary (Commissioned).
- A 8 MW Small Hydro Project at the outfall of cooling water return channel (under commissioning).

It is now proposed to augment the capacity by addition of 2x660 MW units using coal. The units under Stage-I (5x200 MW) shall be decommissioned after commissioning of Stage-III (2x660 MW) units.

NTPC proposed expansion of Singrauli STPP by addition of 1x500 MW unit in 2009. TOR for SSTPS Stage-III (1x500 MW) was accorded by MoEF vide letter no. J-13012/7/2009-IA.II(T) dtd. 25.05.2009, based on which EIA Study was undertaken and Public Hearing in UP was conducted. However, Public Hearing in MP (applicable due to location of proposed ash dyke area in MP) could not be undertaken due to delay in availability of land at that time and application for Environmental Clearance was not processed due to non-availability of coal and non-conductance of Public Hearing in MP. The TOR expired on 24.05.2013.

NTPC Limited (A Govt. of India Enterprise), is the largest power generating company in India. It was set up by Government of India (GoI) in November, 1975 with the objective of planning, promoting and organizing integrated development of thermal power in the country. In 1997 NTPC was conferred “Navratna” status by GoI and in 2007, it became the first public sector company to be granted “Maharatna” status. NTPC is now emerging as a well-diversified company on its way of becoming an Integrated Power Major, having entered into hydro power, coal mining, power

trading, equipment manufacturing, power distribution business and renewable energy generation. Company also plans to enter into nuclear power development.

Presently, NTPC generates power from Coal, Gas, Solar & Hydro projects. With an installed capacity of 47,228 MW, NTPC is the largest power generating major in the country. Additional capacity of about 24,059 MW is under construction at various locations in India. It has also diversified into coal mining, power equipment manufacturing, oil & gas exploration, power trading & distribution. With an increasing presence in the power value chain, NTPC is well on its way to becoming an Integrated Power Major.

2.2 Brief Description and Nature of the Project

Singrauli STPP Stage-III shall be a pulverised coal fired thermal power project based on super critical boiler parameters. The proposal involves construction and operation of two units of 660 MW each. The main components of the project include:

- *Steam Generator, Turbine Generator and Auxiliary Units,*
- *Coal Handling System including Dust Extraction and Suppression System,*
- *Closed Cycle Cooling System with Cooling Towers,*
- *Water & Effluent Treatment System,*
- *Fire Protection System,*
- *Air Conditioning & Ventilation System,*
- *Electrostatic Precipitators, NOx Control and Flue Gas Desulphurisation System*
- *Limestone and Gypsum Storage and Handling System*
- *Chimney,*
- *Ash Handling System with Dry Ash Extraction and wet mix system, Storage and Disposal Facilities,*
- *Electrical Systems: Generator Bus Duct, Transformers, Switchgears, Switch Yard etc.*

2.3 Need for the Project & Its Importance to the Country & Region

Power is one of the key infrastructural elements for the economic growth of a country. Proposed Singrauli STPP Stage-III is envisaged as a base load station to meet the power demand of Uttar Pradesh and other States in Northern Region.

2.4 Demand Supply Gap

The anticipated power demand supply position of India during 2017-18 to 2021-22, shows an overall peak deficit of 4.10% in the country during 2021-22

REGION	UNITS	2017-18	2018-19	2019-20	2020-21	2021-22
PEAK AVAILABILTY	MW	227586.1	240077.7	251534.3	263361	271912
PEAK LOAD	MW	214093	229465	246068	264041	283470
SURPLUS/DEFICIT	MW	13493.1	10612.7	5466.3	-680	-11558
SURPLUS/DEFICIT	**%**	**6.30**	**4.60**	**2.20**	**-0.30**	**-4.10**
ENERGY AVAILABILTY	MKWH	1638804.7	1736164.3	1826191.4	1873135.6	1972226.1

ENERGY REQUIREMENT	MKWH	1450982	1552008	1660783	1778109	1904861
SURPLUS/DEFICIT	MKWH	187822.7	184156.3	165408.4	95026.6	67365.1
SURPLUS/DEFICIT	%	12.90	11.90	10.00	5.30	3.50

In view of the above, and the fact that the Stage-I units (5x200 MW) are proposed to be decommissioned after commissioning of Stage-III, the implementation of Singrauli STPP, Stage-III (2x660 MW), planned to be commissioned during 2021-2022 is justified.

2.5 Imports vs. Indigenous Production

Not Applicable

2.6 Export Possibility

Not Applicable

2.7 Domestic/ Exports Market

Not Applicable

2.8 Employment Generation (Direct & Indirect) due to the Project

The project will generate direct and indirect employment opportunities as well as opportunities for self-employment. Power projects have mechanised and automated plants. Therefore, the direct opportunities for employment during operation phase are limited. The estimated no. of employees during operation phase of the project is estimated to be about 660. However, during construction phase, the total no. of workers likely to be employed will be much higher (about 2,400). In addition to the people directly involved in construction and operation of the power project, employment opportunities in subsidiary industries and service sectors as well as self employment opportunities shall also be generated.

3.0 Project Description:

3.1 Type of Project, Interlinked Project & Interdependent Project

Singrauli STPP Stage-III, shall be a pulverised coal fired thermal power project based on super critical boiler parameters. There are no other projects interlinked/ interdependent Singrauli STPP, Stage-III.

3.2 Location

The Singauli STPP is located in villages Kota, Chilkatand, Nimiya Tand, Telgawan, Paraswar Raja, Marrak, Meshra, Bhairwan on the northern bank of Rihand reservoir near Shakti Nagar in district Sonebhadhra of Uttar Pradesh close to the state boundary of Madhya Pradesh. Nearby Railway stations are at Shaktinagar and Renukoot located at a distance of about 3 kms and 60 km. respectively. Mirzapur station is approximate

200 km. from the project. The project is approachable from Renukoot-Singrauli road through an approach road and also via Waidhan in Madhya Pradesh (at about 8 km from Waidhan). The nearest airport is Varanasi located at a distance of approximately 200 km from the project site.

Vicinity map of the project is shown in Exhibit-I. The major components of the project are located between the following longitudes and latitudes:

Main Plant	24º05º53" to 24º06º56" N and 82º41º15" to 82º43º17" E
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The main plant of Stage-III (2x660MW) shall be accommodated within existing main plant area. However, for ash disposal approximately 330 acres of additional land is required, for which various alternatives are being considered.

3.3 Details of Alternate Sites

As it is an expansion project for implementing Stage-III units within the land available with NTPC, no alternative sites have been explored for main plant area. However, for ash disposal, approximately 330 acres of additional land is required. For disposal of ash, the following options are being considered:

a) NTPC is exploring the availability of mine voids for disposal of ash from Singrauli STPP, Stage-III (2x660 MW). The use of mine voids for ash disposal is subject to detailed studies and permission from MOEF&CC.

b) In 2010, an area of land of about 300 acre was identified for ash disposal from the then proposal of Singrauli STPP Stage-III (1x500 MW) in Madhya Pradesh. The process of land acquisition started, but not completed as the project was delayed. Same land can be considered for ash disposal of 2x660 MW.

c) As an alternative, part of the land available in the existing township of Singrauli STPS can be considered for ash pond and the township may be relocated.

3.4 Size & Magnitude of Operation

NTPC is already operating a project with 2,000 MW coal based and 15 MW solar based capacity at the same location. The capacity of the proposed expansion would be 1320 MW with installation of 2 units of 660 MW each. It is proposed to decommission the Stage-I units (5x200 MW) after commissioning of Stage-III units (2x660 MW). It will consume about 6.5 Million Tonnes of coal per annum and 33 cusecs of water. The project will operate round the clock in three shifts of operation.

3.5 Project Description & Process Details

In a thermal power plant, the chemical energy of the fuel (coal) is first converted into thermal energy (during combustion), which is then converted into mechanical energy (through a turbine) and finally into electrical energy (through a generator). The schematic diagram of the process of power generation a coal based thermal power plant is shown in **Exhibit II**. It has the following steps:

(1) The coal is transferred from the coal handling plant by conveyor belt to the coal bunkers, from where it is fed to the pulverizing mills, which grind it to fine powder. The finely powdered coal, mixed with air is then blown into the boiler by a fan where it burns like a gas.

(2) The process of combustion releases thermal energy from coal. The boiler walls are lined with boiler tubes containing high quality de-mineralized water (known as boiler feed water). The combustion heat is absorbed by the boiler tubes and the heat converts the boiler feed water into steam at high pressure and temperature. The steam, discharged through nozzles on the turbine blades, makes the turbine to rotate, which in turn rotates the generator coupled to the end of the turbine. Rotation of generator produces electricity, which is passed to the step-up transformer to increase its voltage so that it can be transmitted efficiently. The power is evacuated via switchyard through a Transmission System.

(3) During combustion, the non-combustible part of coal is converted into ash. A small part of ash (about 20%) binds together to form lumps, which fall into the ash pits at the bottom of the furnace. This part of ash, known as bottom ash is water quenched, ground and then conveyed to pits for subsequent disposal to ash disposal area or sale.

(4) Major part of the ash (about 80%) is in fine powder form, known as Fly Ash, and is carried out of the boiler along with the flue gas. The flue gas, after heat recovery, is passed through the electrostatic precipitators, where the ash is trapped by electrodes charged with high voltage electricity.

(5) NOx emission from the steam generator shall be controlled by employing low NOx burners (LNB), combustion staging and reducing NOx in the tail flue gas. Suitable technology, taking into consideration the boiler furnace conditions and high ash Indian coals, for reduction of NOx to N2 using either SNCR (selective non catalytic reduction) or SCR (selective catalytic reduction) technology as applicable shall be employed.

(6) Wet lime stone based flue gas desulphurization (FGD) system shall be installed at the tail end of the steam generator downstream of the ESP, in which SO2 gas shall be captured in limestone slurry to produce gypsum. The FGD System shall be provided with bypass system. Necessary auxiliary equipment and systems like crushers, mills, cyclones, vacuum filters, belt conveyors, pumps, storage vessels for different liquids, piping and fittings, zero liquid discharge (ZLD) etc. shall complete the FGD plant.

(7) The flue gases exiting from the FGD System shall be discharged through a tall chimney for wider dispersal of remaining ash particles and gases. The ash collected in the ESP hoppers is extracted in dry form and conveyed to dry ash

storage silos from where it is supplied to user industries.

(8) Any unused part of fly ash is mixed with water and conveyed to ash disposal area in a slurry form.

(9) The steam, after passing through the turbines, is condensed back into water in condensers and the same is re-used as a boiler feed water for making steam. The reasons for condensing and reusing the steam are following: -

- *The cost of boiler feed water is very high as it is very pure demineralised water hence reuse is economical.*
- *The use of condenser lowers the temperature at the exit end and hence increases the efficiency of the turbine.*

(10) The condenser contains tubes through which cold water is constantly pumped. The steam passing around the tubes of condenser loses heat and condenses as water. During this process, the steam gets cooled while cooling water gets heated up (by about 10^{o}C). This hot water is cooled in a cooling tower and recycled for cooling.

However, in order to control dissolved solids, a certain amount of blow down is required from the cooling towers, which is used in the plant for other usages such as service water, coal dust suppression etc.

3.6 Requirement of Raw Materials

Coal, Lime stone and Water are the main raw materials proposed to be used in Singrauli STPP Stage-III for power generation.

In addition, Heavy Furnace Oil/ HPS/ LSHS shall be used during start-up, warm up and low load (up to 30%) operations. Light Diesel Oil (LDO) firing shall be used to facilitate cold start-up of the unit when no auxiliary steam is available for HFO heating and atomization.

Coal shall be transported from the coal mines to the power plant by Merry Go Round System while the lime stone shall be transported through trucks via road. Water shall be transported through pipeline. Fuel Oils may be transported through rail/ road depending on type/ source.

3.7 Resource Optimization, Recycle & Reuse

Coal, Water and Land are the three main natural resources required for setting up of Singrauli STPP Stage-III. With extensive experience in thermal power generation, NTPC shall make the best efforts to optimize the utilization of resources.

Singrauli STPP Stage-III shall be based on super critical boiler parameters, which higher thermal efficiency as compared to conventional pulverized coal has fired units based on sub-critical boiler parameters. The increase in efficiency results in lower coal consumption as well as lower generation of ash and gaseous emissions per unit of electricity generated. NTPC shall make maximum efforts to utilize the ash generated from the project.

While developing the details of water system for the project utmost care shall be taken to minimize water requirement as well as effluent generation. Main features of the water system shall include:

- Recirculating type C.W. system with cooling towers.
- Utilisation of Cooling Tower blow down for Coal dust suppression and extraction system, Service water system, Ash handling and Fire fighting
- Recycle and reuse of effluents from coal dust suppression and extraction system and service water system
- Ash water recirculation system.
- Recirculation of filter backwash to clarifier inlet.
- The treated effluents conforming to the prescribed standards only shall be recirculated and reused within the power plant and the complete power plant shall be designed as a Zero Liquid Discharge (ZLD) Plant.

3.8 Availability of Water & Power

The water requirement is estimated to be about 33 cusec, which is proposed to be drawn from the discharge channel of Singrauli Stage-II. The water consumption of proposed project with 100% fly ash utilization, will meet new environmental norms (2.5 m^3/hr/MW) for water consumption in thermal power plants.

The requirement of the construction power supply for the project would be met from the existing 11 KV Colony Switchgear located near 132 KV switchyard, Necessary 11 KV ring main LT substation shall be provided for the required power plant area.

3.9 Quantity of Wastes to be Generated

The wastes generated in a coal based power station consist of flue gas and ash generated due to combustion of coal and liquid effluents generated due to cooling, various industrial processes and domestic use of water.

Ash generated due to combustion of coal will be the main industrial/ solid waste generated from the project. About 80% of the ash shall be generated as Fly Ash while 20% of the ash shall be generated as bottom ash. With average annual coal requirement of 6.5 MTPA and average 40% ash in coal, it is estimated that about 2.6 MTPA of ash shall be generated annually.

In addition, gypsum shall be generated as solid waste from FGD system, which shall be utilised/ disposed of in an environmentally suitable manner.

The project will have Zero Liquid Discharge system (ZLD). Arrangement shall be made that effluent and storm water do not get mixed. All liquid effluents shall be collected and treated to meet the latest effluent norms prescribed by SPCB/CPCB. The treated effluents conforming to the prescribed standards only shall be recirculated and reused within the power plant and the complete power plant shall be designed as Zero Liquid Discharge plant.

3.10 Schematic Representation of Feasibility Drawing

A schematic of power generation process is presented in Section 3.4 above and Exhibit-II. A conceptual lay-out plan of the project is presented in Exhibit-III. Further details like Lay-Out Plan, Plant Sections etc. shall be worked out during Feasibility Study/ Detailed Engg. Stages.

4.0 Site Analysis

4.1 Connectivity

The Singrauli STPP is located on the northern bank of Rihand reservoir near Shakti Nagar in District Sonebhadhra of Uttar Pradesh close to the neighbouring state boundary of Madhya Pradesh. The Singrauli STPP is approachable from Renukoot-Singrauli road through an approach road already constructed during Stage-I of this Station.

4.2 Land Form, Land Use and Ownership

During the implementation of Singrauli STPS, Stage-I & Stage-II (5x200 MW + 2x500 MW), a total area of about 4491 acres of land was acquired, which is under industrial use with the following break-up.

- Plant Area: 660.0 Acres
- Colony Area: 683.0 Acres
- MGR: 179.22 Acres
- Discharge Canal: 223.66 Acres
- Ash Disposal Area 1516.58 Acres
- R&R & Labour colony: 180.0 Acres
- Hill Park & Green belt: 967.97 Acres
- Approach Road: 81.0 Acres

The main plant of Stage-III (2x660MW) shall be accommodated within existing main plant area. For ash disposal approximately 330 acres of additional land is required, for which various alternatives are being considered, such as mine void filling, acquisition of additional land or use of part of the township area after relocation of township.

4.3 Topography

Singrauli STPS is located in a hilly terrain with the RL of plant area varying between 275 to 285 meters above mean sea level. The plant area is surrounded by hills of 360 meters in the northern side, while Govind Ballabh Pant Sagar exists in the south eastern side. The township of project is located in the north-west direction at an elevation ranging from 280 – 300 meters. The general slope of the area is from north-west to south-east. Further, up in the north of the project, there exists no. of hills and coal mines of NCL.

4.4 Existing Infrastructure/ social infrastructure

As Singrauli Region is an industrialized area and the Singrauli STPP already exists at the same location for more than three decades, the physical and social infrastructure is well developed. However, a detailed analysis of infrastructure available at site shall be undertaken during EIA Study.

4.5 Soil Classification

Please refer Appendix-I of the Pre- Feasibility Report.

4.6 Climatic Data from Secondary Sources

Long term climatic data from IMD Station Sidhi (Station code 42577, located at about 80 km from the project site) for atmospheric pressure, temperature, relative humidity, rainfall, wind speed and direction, measured twice a day viz., at 0830 and 1730 hr. is as follows:

Month	Atmospheric Pressure (Mb)		Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)
	0830	1730	Max	Min	0830	1730	
January	985.4	982.1	32.4	8.5	73	42	0.0
February	983.4	980.0	31.2	11.0	67	36	0.0
March	981.0	977.0	37.6	15.5	46	25	0.0
April	977.0	972.8	43.4	22.8	34	20	0.0
May	972.8	968.4	44.8	27.6	49	33	40.0
June	969.0	965.4	41.0	26.9	70	59	177.0
July	968.5	965.7	37.8	25.5	82	77	665.8
August	969.9	967.2	36.0	25.7	80	72	147.4
September	974.2	971.0	35.6	23.8	84	75	204.4
October	980.0	976.8	37.4	20.3	68	46	0.0
November	984.1	980.8	34.0	14.4	64	50	0.0
December	985.9	982.6	29.6	8.0	66	49	0.0
Total							**1234.6**

Source: India Meteorological Department, Sidhi

Generally, light to moderate winds prevail throughout the year. Winds were light and moderate particularly during the morning hours. While during the afternoon hours the winds were stronger.

Season	First Predominant Winds		Second Predominant Winds		Calm Condition (%)	
	0830	1730	0830	1730	0830	1730
Winter	West (4.5 %)	West (10.7 %)	East (2.2 %)	East (3.3 %)	93.0	80.0
Pre-Monsoon	West (16.7 %)	West (47.3 %)	East (4.3 %)	East (6.4 %)	75.6	35.3
Monsoon	West (29.2 %)	West (25.2 %)	East (8.0 %)	East (7.5 %)	55.8	59.5
Post Monsoon	West (4.0 %)	West (4.5 %)	East (1.5 %)	East (2.5 %)	93.5	91.5
Annual	West (13.6 %)	West (21.8 %)	East (4.0 %)	East (4.9 %)	79.5	66.6

Source: India Meteorological Department, Sidhi

Note: Figures in parenthesis indicates % of time wind blows

Based on historical data on meteorological parameters, the year may broadly be divided into four seasons:

- Winter season : December to February
- Pre-monsoon (Summer) season : March to May
- Monsoon season : June to September
- Post-monsoon season : October to November

Onsite monitoring of meteorological parameters undertaken at SSTPP colony, Shakti nagar from October 2009 to September 2010 is as follows:

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Atmospheric Pressure (mb)	
	Min	Max	830 hrs	1730 hrs	Total	830 hrs	1730 hrs
October' 09	14.9	33.6	49	85	8.6	993.7	991.5
November' 09	16.4	32.2	46	81	61	987.5	984.6
December' 09	10.3	23.8	43	74	7.8	986.3	983.5
January' 10	9.5	31.8	41	69	Nil	988.6	983.8
February' 10	12.4	32.5	39	61	10.6	986.3	981.2
March' 10	17.4	39.3	23	42	Nil	982.2	978.3
April' 10	23.2	44.6	22	32	9.0	979.4	975.5
May' 10	28.1	45.2	35	45	15.6	973.1	969.4
June' 10	26.9	42.5	61	72	137.5	980.5	972.7
July' 10	23.8	38.2	75	78	486.3	984.6	978.2
August' 10	22.8	36.2	70	83	270.8	987.6	982.8
September' 10	19.6	34.8	73	88	182.4	990.3	987.1
Range	**9.5-45.2**		**22-88**		**1189.6**	**969.4-993.7**	

Source: Vimta Labs Limited, Hyderabad

Season	Post Monsoon Season	Winter Season	Pre Monsoon Season	Monsoon Season
1st Predominant Wind Direction	W (5.9 %)	W (9.1 %)	W (17.8 %)	W (25.5 %)
2nd Predominant Wind Direction	E (4.4 %)	E (4.0 %)	WNW (9.2 %)	SW (11.1 %)
Predominant Wind Speeds (kmph)	1.0 - 5.0	1.0 – 5.0	1.0 – 5.0	1.0 – 5.0
Calm conditions (%)	74.0 %	72.0 %	32.4 %	21.5

Source : Vimta Labs Limited, Hyderabad
Note: Figures in parenthesis indicates percentage of time wind blows

4.7 Social Infrastructure Available

As Singrauli Region is an industrialized area and Singrauli STPP and Vindhyachal STPP already exists at the same location (within few kilometers) for more than three decades, the physical and social infrastructure is well developed. The townships of both the projects are already provided with various amenities/ facilities like Hospital (general hospital with support facilities), Pre-Nursery/Nursery School, Higher

Secondary School, Bank, Post Office, Telephone Exchange, Shopping Centre, Transport Centre, Petrol Pump, Community Center/ Club/ Welfare Association, Bal Bhawan, Sports Complex, Auditorium, etc. In addition to the above, similar facilities are also developed by other industries like various coal mining projects of Northern Coalfields Limited, other power plants and municipal authorities.

5.0 Planning Brief

5.1 Planning Concept

The planning of power projects is based on demand & supply scenario of the country/ region, which is based on Electrical Power Survey conducted by CEA. Once the necessity of the project, based on demand and supply gap is established, the site for project is selected based on the following considerations:

i. Availability of suitable and adequate land
ii. Availability of reliable source of water
iii. Availability of coal
iv. Road and railway access
v. Availability of infrastructural facilities
vi. Conformity of Environmental Guidelines

5.2 Population Projection

Power projects are highly mechanised and automated plants. Therefore, the direct opportunities for employment during operation phase are limited. The estimated no. of employees during operation phase of the project is estimated to be about 660. Singrauli STPP is already having a full-fledged township for housing about 2700 families including CISF Personnel. The township shall be augmented to cover the personnel to be deployed under Stage-III. However, during construction stage, the number of workers will be much higher (about 2400). Temporary labour colonies with amenities like water supply and sanitation facilities shall be developed for the construction phase.

5.3 Land Use Planning

During the implementation of Singrauli STPS, Stage-I & Stage-II (5x200 MW + 2x500 MW), a total area of about 4491 acres of land was acquired, with the following break-up.

Sr. No.	Description	Area in Acres
1	Plant Area	660.0 Acres
2	Colony Area	683.0 Acres
3	MGR	179.22 Acres
4	Discharge Canal	223.66 Acres
5	Ash Disposal Area	1516.58 Acres
6	R&R & Labour colony	180.0 Acres
7	Hill Park & Green belt	967.97 Acres
8	Approach Road	81.0 Acres
	Total	**4491 Acres**

The main plant of Stage-III (2x660MW) shall be accommodated within existing main plant area. For ash disposal approximately 330 acres of additional land is required, for which various alternatives are being considered, such as mine void filling, acquisition of additional land or use of part of the township area after relocation of township.

5.4 Assessment of Infrastructure Demand and Amenities/ Facilities Planned

As already mentioned under Para 4.7 above, the physical and social infrastructure is well developed. However, existing amenities/ facilities in the area shall be strengthened during implementation of Stage-III.

6.0 Proposed Infrastructure

6.1 Industrial Area

Major components of main power house complex are

- Main Plant Building
- Coal Handling & Storage Area
- Fuel Oil Handling & Storage Area
- Makeup Water System and Water Treatment Plant
- Cooling System with Cooling Towers
- Effluent Treatment Plant
- Electrostatic Precipitators, FGD and Chimney
- Limestone and gypsum storage and handling areas
- Ash Handling Plant
- Switch Yard etc.

In addition, the project will have an ash disposal area connected with the main plant area through service roads and ash pipelines.

Power evacuation is proposed by providing a 765 KV GIS switchyard. Exact location of switchyard and routing of transmission line shall be finalised after detailed survey/Study. Prima facie, based on feedback of joint team, power evacuation seems feasible.

6.2 Residential Area

The project is already having a full-fledged township consisting of various residential and non-residential buildings. The residential buildings is being used to house the staff of NTPC, CISF, Support Staff & staff of Associate Agencies, Trainees Hostel (Rooms), Guest Houses, Field Hostel etc.

Non-residential Buildings includes Training Centre (Including Workshop), Hospital (general hospital with support facilities), Administrative Office, Pre-Nursery/Nursery School, Higher Secondary School, Bank, Post Office, Telephone Exchange, Shopping Centre, Transport Centre, Petrol Pump, Community Center/ Club/ Welfare Association, Bal Bhawan, Sports Complex, Auditorium, CISF Armoury etc.

The existing amenities/ facilities in the area shall be strengthened during implementation of Stage-III.

6.3 Green Belt

The layout of Singrauli STPS was designed in 1970s with little emphasis on green belt development. However, NTPC has undertaken massive afforestation programme in and around the project and more than 14.4 Lacs trees have been planted so far. Afforestation and green belt development shall be undertaken in all available spaces in plant and township areas during Stage-III also.

6.4 Social Infrastructure

As already mentioned under Para 4.7 above, the physical and social infrastructure is well developed. However, existing amenities/ facilities in the area shall be strengthened during implementation of Stage-III.

6.5 Connectivity

The Singrauli STPP is well connected through road, rail and air routes. Nearby Railway stations are at Shaktinagar and Renukoot located at a distance of about 3 kms and 60 km. respectively. Mirzapur station is approximate 200 km. from the project. The project is approachable from Renukoot-Singrauli road through an approach road and also via Waidhan in Madhya Pradesh (at about 8 km from Waidhan). The nearest airport is Varanasi located at a distance of approximately 200 km from the project site.

6.6 Drinking Water Management

Entire Main Plant and Township areas has been provided with piped drinking water supply with a water treatment plant. The same shall be upgraded to include the main plant and township areas of Stage-III.

6.7 Sewerage System

Entire Main Plant and Township areas has been provided with an underground sewerage system with a sewage treatment plant based on biological process for treatment of sewage. The same shall be upgraded to include the main plant and township areas of Stage-III.

6.8 Industrial Waste Management

Operation of Singrauli STPP, Stage-III shall generate the following major types of industrial wastes:

1. Flue Gas due to combustion of coal
2. Effluents due to treatment and use of water and
3. Solid wastes in the form of ash (fly ash and bottom ash) and gypsum

As discussed in Para 3.5 above, the flue gases shall be cleaned in Electrostatic Precipitators, NOx Control System and Flue Gas Desulphurisation System and the cleaned gases shall be discharged through a 275 m tall stacks for wider dispersal of remaining pollutants.

Further, a comprehensive effluent management scheme including recycle and reuse of effluents shall be envisaged for treatment and reuse of effluents. The treated effluents conforming to the prescribed standards shall be recirculated and reused within the power plant and the complete power plant shall be designed as Zero Liquid Discharge plant.

The details of solid waste management are presented in Para 6.9.

6.9 Solid Waste Management

The Ministry of Environment, Forests and Climate Change has issued a Gazette Notification dated 03-11-2009 which is an amendment to its earlier notifications dated 14-09-1999 and amendment dated 27-08-2003. The new notification stipulates that all coal based power stations/ units commissioned after the date of issue of notification have to utilize at least 50% of ash generated within 1 year, 70% within 2 years, 90% within 3 years and 100% within 4 years respectively from the commissioning of the units. The notification dated 03-11-2009 further amended on 25-01-2016 also calls for utilization of 100% ash generated.

However, due to existence of a large number of thermal power projects (Singrauli STPS, Rihand STPS, Vindhyachal STPP, Anpara TPS, Lanco Anpara STPP, Sasan STPP, and Renusagar Power Corporation) in the Singrauli region and lack of major construction activities and lack of market for ash based products, the scope of ash utilisation is limited. However, NTPC always gives adequate thrust for ash utilisation and it shall prepare a plan for 100% ash utilisation for Singrauli STPP, Stage-III.

Ash generated due to combustion of coal will be the main industrial/ solid waste generated from the project. About 80% of the ash shall be generated as Fly Ash while 20% of the ash shall be generated as bottom ash.

The fly ash shall be extracted in dry form from the electrostatic precipitator hoppers. This dry ash shall either be taken to buffer hoppers for its onward transportation in dry form for utilization or shall be slurrified in wetting units for its ultimate disposal in ash disposal area. The bottom ash shall be extracted and disposed off in wet form. It is envisaged to have disposal system sized for 100% generation of ash.

The ash management scheme for fly ash and bottom ash involves dry collection of fly ash, supply of ash to entrepreneurs for utilisation, promoting ash utilisation and safe disposal of unused ash. NTPC shall make maximum efforts to utilise the fly ash for various purposes. Unused fly ash and bottom ash shall be disposed off in the ash pond. A blanket of water shall be maintained over the entire ash pond to control fugitive dust emission. After the ash pond is abandoned, it shall be reclaimed through green vegetation.

Gypsum generated from FGD system shall also be utilised/ disposed of in an environmentally suitable manner.

6.10 Power Requirement & Source

The requirement of the construction power supply for the project would be met from the existing11 KV Colony Switchgear located near 132 KV switchyard. Necessary 11 KV ring main/LT sub-station shall be provided for the required power plant area. The startup power of the plant has been envisaged to be drawn from the existing 132 KV system itself through 132 KV startup/ standby transformer.

7.0 Rehabilitation and Resettlement (R&R) Plan

The main plant of Stage-III (2x660MW) shall be accommodated within existing main plant area and no additional land is proposed to be acquired. For ash disposal approximately 330 acres of additional land is required, for which various alternatives are being considered, such as mine void filling, acquisition of additional land or use of part of the township area after relocation of township.

In case, additional land for ash dyke area is acquired, a detailed Socio Economic Survey would be undertaken for the project affected persons due to land acquisition for the project and a comprehensive R&R plan covering Resettlement, Rehabilitation and Community Development Activities would be formulated in consultation with the stakeholders, as per the provisions of NTPC/State R&R policy.

R&R Plan shall broadly cover the following activities:

- Constitution of Village Development Advisory Committee (VDAC)
- Preparation of R&R Plan in consultation with the stakeholders
- Capacity building of PAPs
- Facilitating gainful engagement to PAPs
- Community Development activities in the vicinity and affected villages.
- Social Impact Evaluation (SIE) of R&R programme.

Skill Development Activities under R & R plan shall cover

- Vocational Training for self employment will be given to displaced families.
- Job oriented /Skill Development Training will be given to eligible PAPs e.g driving, tailoring, livestock etc

Due to implementation of the project, a number of self employment opportunities for PAPs shall also be generated, such as

- Allotment of Shops & Stalls in township.
- Formation of co-operative society for Hiring of vehicles, Award of Petty contracts works, Green Belt Development/ Plantations etc.

NTPC Singrauli STPP is already undertaking community development activities in the neighbouring area in the following areas. The same shall be further enhanced based on budgets available under Stage-III and based on need assessment survey of the surrounding villages.

Health	Upgradation of local PHC with equipments and infrastructure
	Partnership with Govt for National Health Programmes like Polio, TB, Malaria etc
	Health Camps for Family Planning and communicable diseases.

	Subsidised treatment in company hospitals
	Specific programmes to improve health indicators e.g fertility rates, mortality rate, nutrition levels of children and vulnerable
	Specific Programmes for hygiene and sanitation
Education	Targeted programmes for primary education specially for girl child
	Augmentation of infrastructure and equipments, furniture, blackboard, toilets etc in villages schools
	Scholarships to meritorious students
	Adult education
	Partnerships in state sponsored education programmes
Physically Challenged	Helping aids to each category of physically challenged as per requirement
	Health Camps
Water Supply	Provision of potable drinking water supply in affected villages thru wells, hand pumps, tankers etc
	Awareness campaigns for water borne diseases, sanitation and hygiene
Capacity Building	Setting up new ITI with necessary infrastructure and machinery
	Sponsorship of PAPs / wards
	Short term courses for skill up gradation
	Vocational training (dairy, poultry, bee keeping, sericulture)
	Specific Programmes for Ladies (stitching, embroidery, tailoring etc)
Infrastructure Development	Construction of roads, drainage, community halls, school buildings, health centres, street lighting, equipments to educational institutions, public utilities, sanitation facilities, Health centres etc in nearby and affected area
Sports and Culture	Regular Rural Sports
	Facilitation / Sponsorship to local talent
	Promotion of local festivals
	Participation of local community in national festivals
	Preservation of culture and heritage

8.0 Project Schedule & Cost Estimates

As per CERC norms, Commercial Operation Date (COD) of first 660 MW unit of Singrauli STPP Stage-III will be in 52 months from the Investment approval and subsequent units after an interval of 6 months thereafter.

In absence of detailed Bill of Quantities, approximate project capital cost (including interest during construction and working capital margin) for the purposes of Pre-Feasibility Report has been worked out as Rs 7 Crore/MW based on recently cleared projects of similar capacity and considering debt-equity ratio of 70:30.

9.0 Analysis of Proposal (Final Recommendations)

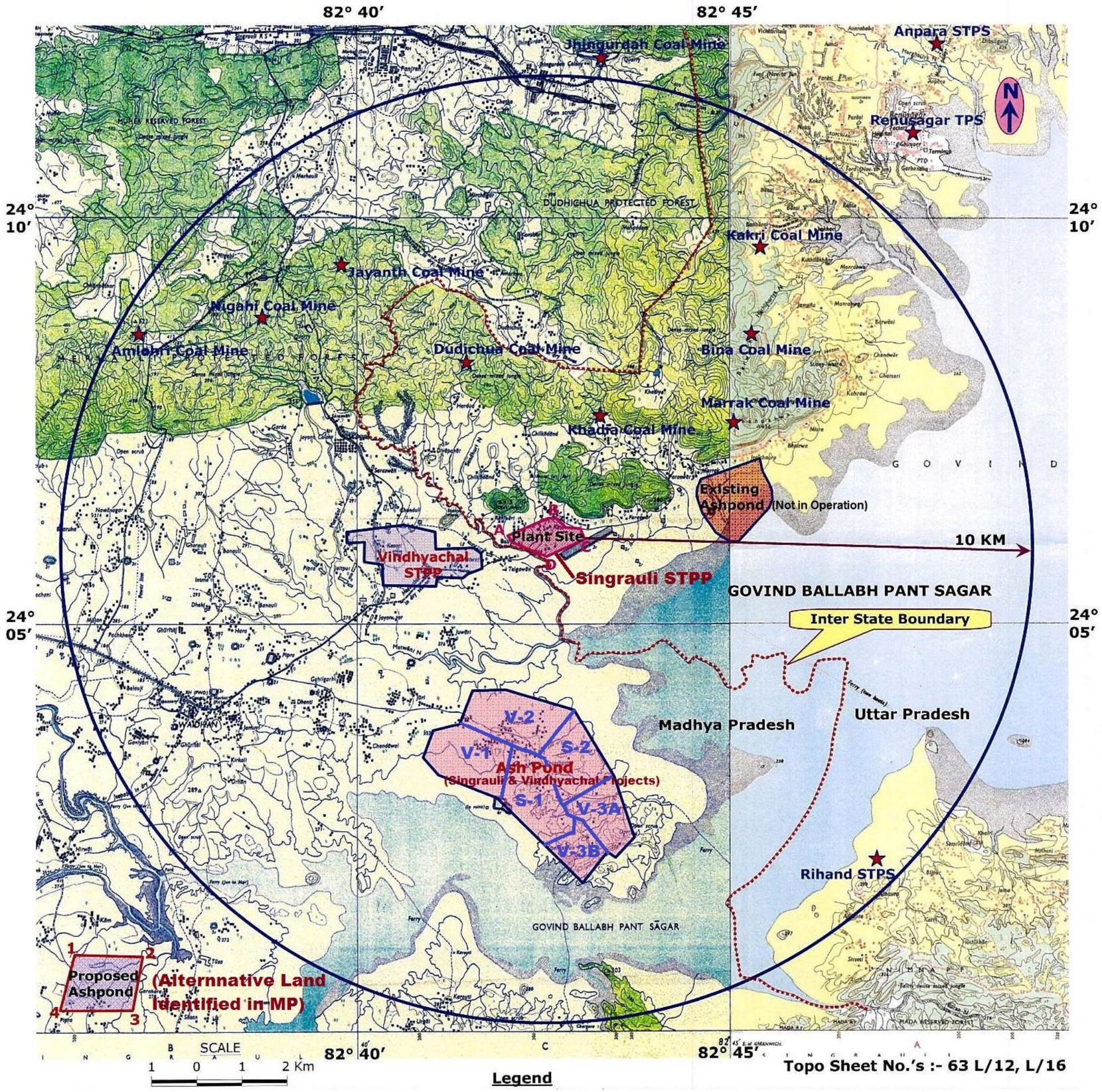
Keeping in view the availability of sufficient land, nearness of source of water, proximity to coal source and generally meeting the requirements of environmental guidelines, the site is considered prima-facie feasible for addition of 2x660MW units. Further, the Stage-I units (5x200 MW) are proposed to be decommissioned after commissioning of Stage-III units (2x660 MW), leading to the following benefits:

- Increase in power generation with reduction in pollution load
- Improvement in efficiency of the project, leading to reduction in coal consumed per unit of electricity generated
- Reduction in emission of CO_2 per unit of electricity generated
- Reduction in emission of SO_2 and NOx per unit of electricity generated as the new units shall meet the emission norms dated 07.12.2015.

Construction and operation of the project will generate employment potential both directly or indirectly. Local people will have employment opportunities as skilled, semi-skilled and unskilled laborers as well as self employment opportunities. Thus there will be overall improvement in the socio-economic status of the people of the surrounding areas. Power plant will have a positive effect on the socio-economic conditions of the people nearby, the project and service activities will generate steady source of income for local people. With the implementation of the project, employment opportunities, communication, medical facilities, education and skill up-gradation facilities etc. in the area will be further improved.

Besides, there will be marked improvement for various facilities in the local areas as shown below.

- Improvement in medical and health care system.
- Improvement in educational services.
- Improvement of drinking water & sanitation facilities.
- Vocational training facilities for local eligible youth of local community to enable them to seek employment in suitable project operations and elsewhere.
- Benefit to the State and the Central governments through financial revenues from this project directly and also indirectly.
- Employment opportunities to local persons of different skills and trades.
- Improvement in the socio-economic conditions of the inhabitants of the area.



Legend

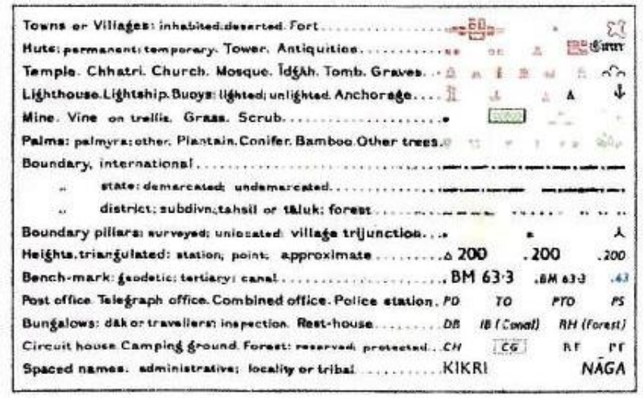


Exhibit-I: Vicinity Map of Singrauli Super Thermal Power Project

Exhibit-II: General Layout Plan

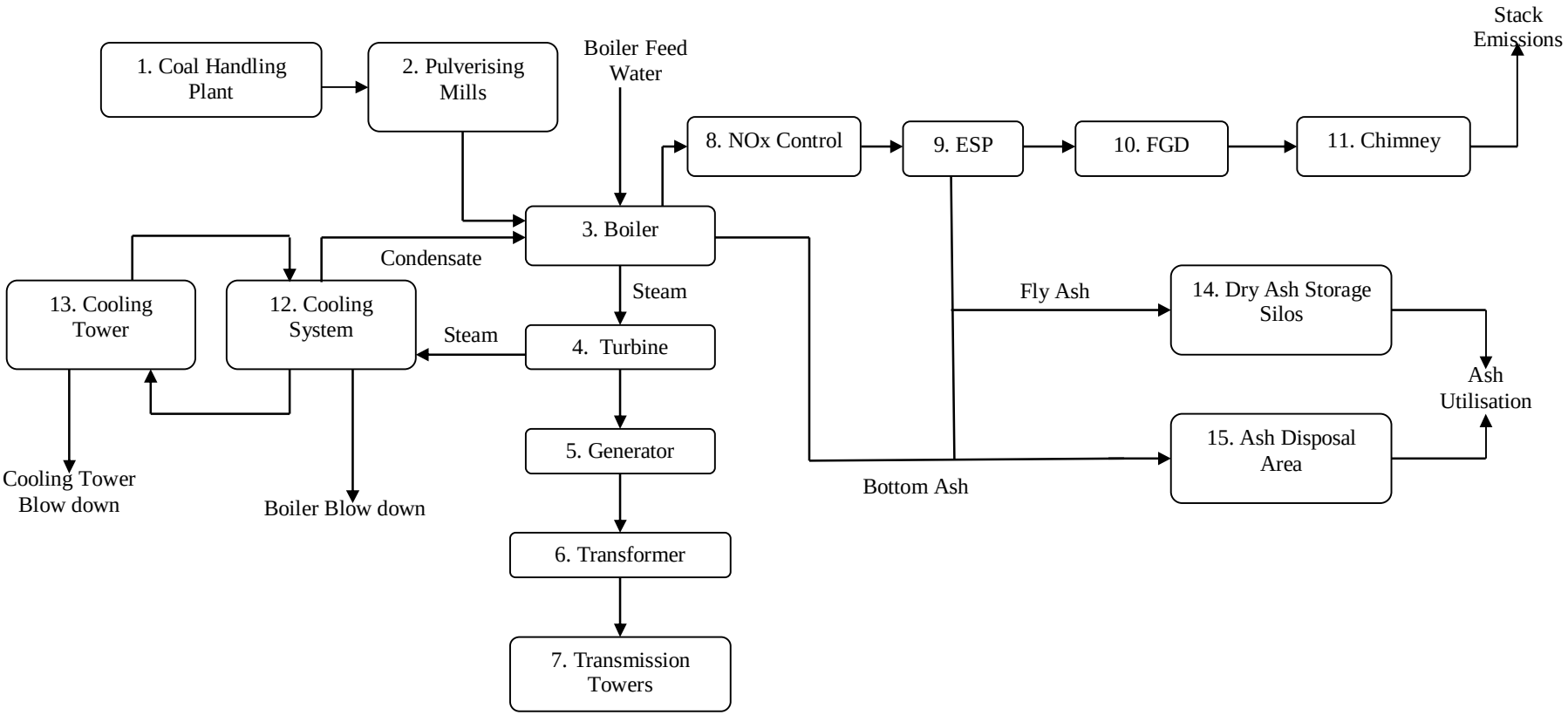
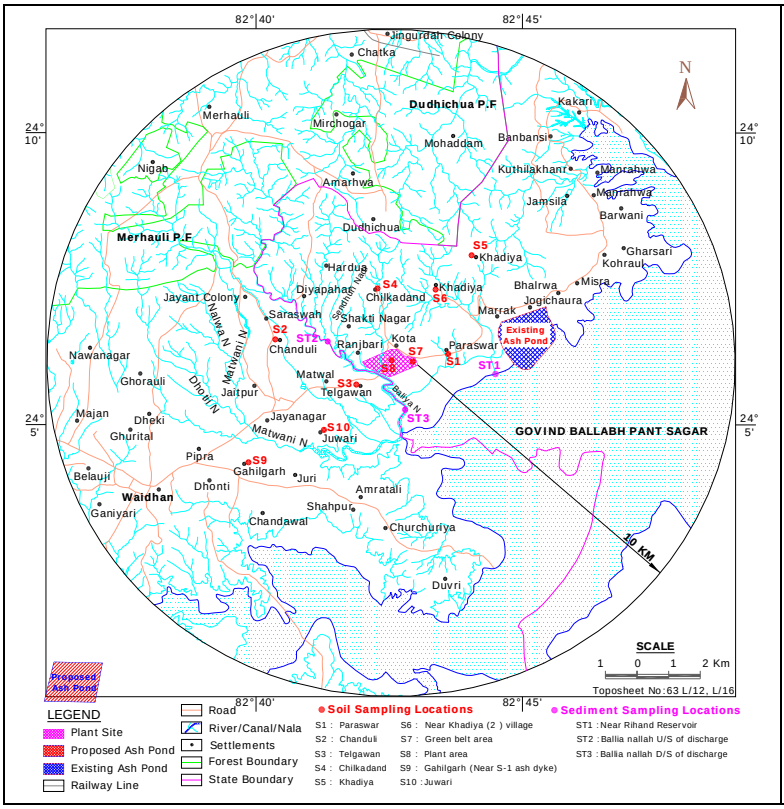


Exhibit-III: Schematic Representation of Thermal Power Generation in Coal Based Thermal Power Plant

Appendix-I

Soil Characteristics in Study Area Around Singrauli STPP

During EIA Study for Singrauli STPP, Stage-III (1x500 MW as proposed in 2009), soil sampling and analysis was undertaken at 10 locations during the post monsoon season 2009 and once during pre-monsoon season 2010.



DETAILS OF SOIL SAMPLING LOCATIONS

S1	Paraswar	1.0 E
S2	Chanduli	2.7 W
S3	Telgawan	0.6 SW
S4	Chilkadand	1.9 N
S5	Khadiya village	3.7 NE
S6	Near Khadiya (2) village	2.2 NNE
S7	Green belt area back side of G.M Banglow	--
S8	Plant area	--
S9	Gahilgarh (Near S-1 ash dyke)	4.9 SW
S10	Juwari village	2.4 SW

SOIL ANALYSIS RESULTS (POST-MONSOON SEASON-2009)

Sr. No.	Parameter	UOM	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	pH (1:5 Aq. Extract)	---	7.9	7.7	8.0	8.4	7.9	8.0	8.2	8.1	7.8	8.2
2	Conductivity (1:5 Aq. Extract)	µS/cm	320	410	280	290	220	286	264	275	290	189
3	Texture	%	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay	Silty clay
4	Sand	%	18	14	24	15	19	16	27	18	12	18
5	Silt	%	50	50	45	45	46	48	38	42	45	40
6	Clay	%	32	36	31	40	35	36	35	40	43	42
7	Bulk Density	g/cc	1.2	1.4	1.3	1.5	1.1	1.1	1.3	1.1	1.2	1.3
8	Exchangeable Calcium as Ca	mg/kg	2816	2354	3248	3564	3142	3627	3391	2752	2214	2841
9	Exchangeable magnesium as Mg	mg/kg	364	412	342	425	391	358	458	329	447	493
10	Exchangeable Sodium as Na	mg/kg	126.3	148.7	139.6	141.5	133.1	128.1	112.3	121.1	156.9	125.3
11	Available Potassium as K	kg/ha	95.6	110	82	90	413.1	693.6	857.4	505.8	754.4	690.9
12	Available Phosphorous as P	kg/ha	59.0	64.3	32.1	39.0	127.5	230.5	172.1	248.4	191.5	228.4
13	Available Nitrogen as N	kg/ha	38.4	49.2	82.2	40.8	36.6	70.4	46.8	43.7	43.5	51.7
14	Organic Matter	%	1.23	1.45	1.64	1.42	1.35	1.76	1.55	1.71	1.50	1.34
15	Water Soluble Chloride as Cl	mg/kg	142.4	133.8	128.6	134.6	139.1	136.9	144.2	153.2	123.9	135.4
16	Water Soluble Sulphate as SO_4	mg/kg	16.8	13.4	20.7	15.5	17.9	23.1	11.7	19.8	16.5	15.8
17	SAR	%	0.16	0.28	0.18	0.25	0.32	0.19	0.17	0.14	0.15	0.21
18	Infilteration test	cm/hr	2.7	2.8	2.9	3.1	2.6	3.2	3.6	3.1	3.4	3.1
19	Cation exchange capacity	meq/100g	22.2	19.6	20.1	19.8	21.6	20.6	21.5	22.9	20.3	21.8

SOIL ANALYSIS RESULTS (PRE-MONSOON SEASON-2010)

Sr. No.	Parameter	UOM	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	pH (1:5 Aq. Extract)	---	7.7	7.5	7.8	8.2	7.7	7.8	8.0	7.9	7.6	8.0
2	Conductivity (1:5 Aq. Extract)	µS/cm	356	428	324	336	268	332	308	362	324	242
3	Texture	%	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay	Silty Clay
4	Sand	%	16	14	18	19	16	16	19	18	15	18
5	Silt	%	48	52	46	51	62	51	46	48	51	44
6	Clay	%	36	34	36	30	22	33	35	34	34	38
7	Bulk Density	g/cc	1.1	1.2	1.1	1.1	1.8	1.1	1.1	1.0	1.2	1.1
8	Exchangeable Calcium as Ca	mg/kg	2436	2106	2862	3214	2818	3242	3018	2214	1926	2534
9	Exchangeable magnesium as Mg	mg/kg	294	362	264	324	308	318	396	284	348	412
10	Exchangeable Sodium as Na	mg/kg	148	132	162	148	148	139.6	149.2	132.8	141.8	149.6
11	Available Potassium as K	kg/ha	106.4	132.6	121.8	113.4	142.8	132.4	124	136.4	124	148
12	Available Phosphorous as P	kg/ha	69.8	82.6	68.2	69.4	86.4	182.4	151.8	186.4	148.6	128.6
13	Available Nitrogen as N	kg/ha	56.8	61.2	51.8	72.9	68.4	86.8	102.8	126.8	96.8	96.8
14	Organic Matter	%	0.62	0.58	0.59	0.71	0.61	1.92	1.86	1.79	1.51	1.38
15	Water Soluble Chloride as Cl	mg/kg	128.1	118.6	142.8	102.4	132.0	148.6	184.2	126.8	132.4	128.6
16	Water Soluble Sulphate as SO_4	mg/kg	36.2	28.6	31.2	28.4	32.4	34.8	46.2	30.6	42.9	40.8
17	SAR	%	0.92	0.87	0.96	0.92	0.92	0.89	0.92	0.87	0.90	0.93
18	Infilteration test	cm/hr	2.5	2.4	2.6	2.9	2.5	3.0	3.4	2.7	2.9	2.9
19	Cation exchange capacity	meq/100g	21.3	18.7	19.4	17.9	20.2	18.7	20.1	21.3	18.2	19.6