Petition No : .....

एनटीपीसी
NTPC
A Maharatna Company

Talcher Super Thermal Power Station Stage-I

(2x500 MW)

TARIFF PETITION FOR THE PERIOD
01.04.2019 TO 31.03.2024

BEFORE THE HON'BLE CENTRAL ELECTRICITY REGULATORY COMMISSION
NEW DELHI

PETITION NO.....

IN THE MATTER OF : Petition Under Section 62 and 79 (1) (a) of the Electricity Act, 2003 read with Chapter-V of the Central Electricity Regulatory Commission (Conduct of Business) Regulations, 1999 and Chapter-3, Regulation-9 of Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2019 for approval of tariff of **Talcher Super Thermal Power Station Stage-I (1000 MW) for the period from 01.04.2019 to 31.03.2024.**

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BEFORE THE HON'BLE CENTRAL ELECTRICITY REGULATORY COMMISSION
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AND
IN THE MATTER OF

Petitioner: : NTPC Ltd.
NTPC Bhawan
Core-7, Scope Complex
7, Institutional Area, Lodhi Road
New Delhi-110 003.

Respondents

1. West Bengal State Electricity Distribution Co. Ltd.
Vidyut Bhawan, Block-DJ,
Sector-II, Salt Lake City
Kolkata – 700 091.

2. North Bihar Power Distribution Company Ltd.
Vidyut Bhawan, Bailey Road
Patna – 800 001.

3. South Bihar Power Distribution Company Ltd.
Vidyut Bhawan, Bailey Road
Patna – 800 001

4. Jharkhand Bijlee Vitran Nigam Ltd
Engineering Bhawan
Heavy Engineering Corporation
Dhurwa
Ranchi-834 004.

5. GRIDCO Ltd.
Vidyut Bhawan, Janpath
Bhubaneshwar – 751 007.

6. The Energy & Power Department
Govt. of Sikkim
Kazi Road , Gangtok
Sikkim – 737 101.

7. Damodar Valley Corporation
DVC Towers, VIP Road
Kolkata – 700 054.

8. Assam Power Distribution Company Ltd
Bijulee Bhawan, Paltan Bazar
Guwahati – 781001.

9. Tamil Nadu Generation & Distribution Co. Ltd
NPKRP Maaligail
800, Anna Salai.
Chennai – 600002.

The Petitioner humbly states that:

1) The Petitioner herein NTPC Ltd., is a Government Company within the meaning of the Companies Act, 2013. Further, it is a 'Generating Company' as defined under Section 2(28) of the Electricity Act, 2003.

2) The Petitioner is having power stations/ projects at different regions and places in the country. Talcher Super Thermal Power Station Stage-I (1000 MW) (hereinafter referred to as TSTPS-I) is one such station located in the State of Odisha. The power generated from TSTPS-I is being supplied to the respondents herein above.

3) Section 62 of Electricity Act, 2003 provides for determination of tariff by the Appropriate Commission for supply of electricity by a generating company. The Hon'ble Commission, under Section 79(1)(a) of Electricity Act, 2003, is vested with the jurisdiction to regulate the tariff of the Generating Companies owned or controlled by the Central Government.

4) The Hon'ble Commission has notified the Central Electricity Regulatory Commission (Terms & Conditions of Tariff) Regulations, 2019 (hereinafter 'Tariff Regulations 2019') which came into force from 01.04.2019, specifying the terms & conditions and methodology of tariff determination under Section 62 & 79 of the Electricity Act, 2003.

5) Regulation 9(2) of Tariff Regulations 2019 provides as follows:

"(2) In case of an existing generating station or unit thereof, or transmission system or element thereof, the application shall be made by the generating company or the transmission licensee, as the case may be, by 31.10.2019, based on admitted capital cost including additional capital expenditure already admitted and incurred up to 31.3.2019 (either based on actual or projected additional capital expenditure) and estimated additional capital expenditure for the respective years of the tariff period 2019-24 along with the true up petition for the period 2014-19 in accordance with the CERC (Terms and Conditions of Tariff) Regulations, 2014."

In terms of above, the Petitioner is filing the present petition for determination of tariff for TSTPS-I for the period from 01.04.2019 to 31.03.2024 as per the Tariff Regulations 2019.

6) The tariff of the TSTPS-I for the tariff period 01.04.2014 to 31.03.2019 was determined by the Hon'ble Commission vide its order dated 29.07.2016 in Petition No. 281/GT/2014 in accordance with the CERC (Terms & Conditions of Tariff) Regulations 2014. The petitioner vide affidavit dtd 13.01.2020 had filed a separate true up petition for the period 01.04.2014 to 31.03.2019 for revision of tariff in line with the applicable provisions of Tariff Regulations 2014.

7) Hon'ble Commission vide order dated 29.07.2016 in Petition no 281/GT/2014 had allowed a capital cost of Rs 2867.19 Cr. as on 31.03.2019 based on the admitted projected capital expenditure for the 2014-19 period. However, the actual closing capital cost as on 31.03.2019 has been worked out in the foresaid true-up petition as Rs 2762.44 Crs based on the actual expenditure after truing up exercise for the period 2014-19. Accordingly, the Petitioner has adjusted an amount of Rs. (-)104.75 Cr from the admitted capital cost as on 31.03.2019 and accordingly the opening capital cost as on 01.04.2019 has been considered as Rs 2762.44 Cr. in the instant petition. The Hon'ble Commission may be pleased to accordingly adopt this adjustment in the admitted capital cost as on 31.3.2019 and determine the tariff in the present petition for the period 2019-24. Similarly Opening Equity and Opening loan as on 01.04.2019 has been considered by petitioner based on true-up petition filed for 2014-19 period, Hon'ble Commission may be pleased to consider the same while determining tariff for 2019-24 period.

8) The capital cost claimed in the instant petition is based on the opening capital cost as on 01.04.2019 as per above and capital expenditures for the period 2019-24 have been projected based on the Regulation 25 and 26 of the Tariff Regulations, 2019.

9) As per Regulation 35(1)(6) of the Tariff Regulations 2019, the water charges, security expenses and capital spares consumed for thermal generating stations are to be allowed separately. The details in respect of water charges such as type of cooling water system, water consumption, rate of water charges as applicable for 2018-19 have been furnished

below. As per Water resources Dept notification dtd 27.09.2016 Water charges/License fees are to be escalated at 10% per year w.e.f 01.04.2017 (Copy of latest water charges attached at **Annexure-I**). Accordingly, water charges may be allowed in tariff based on the same for the 2019-24. In accordance with provision of the Regulations, the petitioner shall be furnishing the details of actuals for the relevant year at the time of truing up and the same shall be subject to retrospective adjustment.

Description	**Remarks**
Type of Plant	Thermal Power Plant
Type of cooling water system	Closed Cycle.
Consumption of Water	2.90 TMC
Rate of Water charges	Rs 6.72 / cum
Total Water Charges	Rs 2100.34 Lakh (proportioned based on MW capacity from total paid amount)

10) Similarly, the Petitioner is claiming the security expenses based on the estimated expenses for the period 2019-24. The actuals for the same shall be furnished at the time of true-up. In respect of capital spares consumption, it is submitted that the same shall be claimed at the time of true-up in terms of the proviso to the Regulation 35 (1)(6) based on actual consumption of spares during the period 2019-24

11) The present petition is filed on the basis of norms specified in the Tariff Regulations 2019. It is submitted that the petitioner is in the process of installing the Emission Control Systems (ECS) in compliance of the Revised Emission Standards as notified by MOEF vide notification dated 07.12.2015 as amended. Completion of these schemes in compliance of revised emission norms will effect the station APC, Heat Rate , O&M expenses etc. In addition the availability of the unit/ station would be also effected due to shutdown of the units for installation of ECS. The petitioner would be filing the details of the same in a separate petition in terms of the Regulation 29 of Tariff Regulations 2019. The tariff of the instant petition would undergo changes consequent to the the order of the Hon'ble Commission in the said ECS petition.

12) A notification dated 25.01.2016 has been issued by Government of India, Ministry of Environment, Forest & Climate Change (MOEFCC) under the statutory provisions of Environment (Protection) Act 1986. The said notification of MOEFCC prescribed for sharing of transportation cost of Fly Ash generated at power stations with the users of Fly Ash. In this regard, Petitioner filed a petition, being no. 172/MP/2016, before the Hon'ble Commission seeking reimbursement of the additional expenditure for Fly Ash Transportation directly from the beneficiaries as the same was in the nature of statutory expense. Hon'ble Commission vide order dated 05.11.2018 disposed of the said petition and directed as follows :

"31. Accordingly, we in exercise of the regulatory power hold that the actual additional expenditure incurred by the Petitioner towards transportation of ash in terms of the MOEFCC Notification is admissible under "Change in Law" as additional O&M expenses. However, the admissibility of the claims is subject to prudence check of the following conditions on case to case basis for each station:
a) Award of fly ash transportation contract through a transparent competitive bidding procedure. Alternatively, the schedule rates of the respective State Governments, as applicable for transportation of fly ash.
b) Details of the actual additional expenditure incurred on Ash transportation after 25.1.2016, duly certified by auditors.
c) Details of the Revenue generated from sale of fly ash/ fly ash products and the expenditure incurred towards Ash utilisation up to 25.1.2016 and from 25.1.2016 to till date, separately.
d) Revenue generated from fly Ash sales maintained in a separate account as per the MoEF notification.

32. The Petitioner is granted liberty to approach the Commission at the time of revision of tariff of the generating stations based on truing –up exercise for the period 2014-19 in terms of Regulation 8 of the 2014 Tariff Regulations along with all details / information, duly certified by auditor."

Petitioner has claimed the additional expenditure towards ash transportation charges for the period 2018-19 in the true-up petition filed vide affidavit dated 13.01.2020 in respect of the instant station.

The expenditure towards the ash transportation charges are recurring in nature. The Petitioner has been incurring ash transportation expenditure in some of its stations in the current tariff period also. In case the same is permitted to be recovered at the end

of the tariff period 2019-24, there will be additional liability on the beneficiary on account of the interest payment for the period till the time the true-up petitions for the period 2019-24 is decided. To avoid the interest payment liability of the beneficiaries it is prayed that the petitioner may be allowed to recover/ pass on the ash transportation charges after adjusting the revenue earned from sale of ash at the end of each quarter of financial year subject to true-up at the end of the period.

13) The Petitioner has already paid the requisite filing fee vide UTR No. CMS 1106438370 on 22.04.2019 for the year 2019-20 and the details of the same have been duly furnished to the Hon'ble Commission vide our letter dtd.25.04.2019. For the subsequent years, it shall be paid as per the provisions of the CERC (Payment of Fees) Regulations, 2012 as amended. Further Regulation 70 (1) of Tariff Regulations 2019 provides that the application fee and publication expenses may be allowed to be recovered directly from the beneficiaries at the discretion of the Hon'ble Commission. Accordingly, it is prayed that Hon'ble Commission may be pleased to allow recover filing fee and publication fee directly from the beneficiaries.

14) The petitioner has accordingly calculated the tariff for 2019-24 period based on the above and the same is enclosed as **Appendix-I** to this petition.

15) The Petitioner has served the copy of the Petition on to the Respondents mentioned herein above and has posted the Petition on the company website i.e. www.ntpc.co.in

16) The petitioner is filing this tariff petition subject to the outcome of its various appeals/ petitions pending before different courts. Besides, the petitions filed by NTPC for determination of capital base as on 31.03.2014 through true-up exercise are pending before the Hon'ble Commission and would take some time. The Petitioner, therefore, reserves its right to amend the tariff petition as per the outcome in such appeals/ petitions, if required.

Prayers

In the light of the above submissions, the Petitioner, prays that the Hon'ble Commission may be pleased to:

i) Approve tariff of Talcher Super Thermal Power Station Stage-I for the tariff period 01.04.2019 to 31.03.2024.

ii) Allow the recovery of filing fees as & when paid to the Hon'ble Commission and publication expenses from the beneficiaries.

iii) Allow reimbursement of Ash Transportation Charges directly from the beneficiaries quarterly on net basis.

iv) Pass any other order as it may deem fit in the circumstances mentioned above.

Petitoner

New Delhi
Date: 30.01.2020

BEFORE THE CENTRAL ELECTRICITY REGULATORY COMMISSION

NEW DELHI

PETITION NO.....

IN THE MATTER OF	:	Petition Under Section 62 and 79 (1) (a) of the Electricity Act, 2003 read with Chapter-V of the Central Electricity Regulatory Commission (Conduct of Business) Regulations, 1999 and Chapter-3, Regulation-9 of Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2019 for approval of tariff of **Talcher Super Thermal Power Station Stage-I (1000 MW) for the period from 01.04.2019 to 31.03.2024.**
Petitioner		NTPC Ltd. NTPC Bhawan Core-7, Scope Complex 7, Institutional Area, Lodhi Road New Delhi-110 003
Respondents:	1	West Bengal State Electricity Distribution Co. Ltd. Vidyut Bhawan, Block-DJ, Sector-II, Salt Lake City Kolkata – 700 091.
		& Others

Affidavit

I, Rohit Chhabra, son of Sh. S M Chhabra, aged about 54 years, having office at NTPC Bhavan, SCOPE Complex, Lodhi Road, New Delhi do solemnly affirm and state as under:

1. That I am the Addl. General Manager (Commercial) in Petitioner Corporation NTPC Ltd. and am well conversant with the facts of the case and am competent to swear the present affidavit.

2. That I have read the contents of the accompanying Petition being filed by NTPC and have understood the same.

3. That the contents of the accompanying Petition being filed by NTPC are based on information available with the Petitioner in the normal course of business and believed by the deponent to be true.

Deponent

Verification

I, the deponent above named, do hereby verify that the contents of the above affidavit are true to the best of my knowledge, no part of it is false and nothing material has been concealed therefrom.

Verified at New Delhi on this day 30th January 2020.

Deponent

NOTARY
GOVT. OF INDIA
NOTARIAL

Notary Public, DELHI

30 JAN 2020

TARIFF FILING FORMS (THERMAL)

FOR DETERMINATION OF TARIFF

FOR

Talcher Super Thermal Power Station Stage-I

(From 01.04.2019 to 31.03.2024)

PART-I

APPENDIX-I

Checklist of Main Tariff Forms and other information for tariff filing for Thermal Stations

Form No.	Title of Tariff Filing Forms (Thermal)	Tick
FORM- 1	Summary of Tariff	✓
FORM -1 (I)	Statement showing claimed capital cost	✓
FORM -1 (II)	Statement showing Return on Equity	✓
FORM-2	Plant Characteristics	✓
FORM-3	Normative parameters considered for tariff computations	✓
FORM-3A**	Statement showing O&M Expenses	✓
FORM-3B**	Statement of Special Allowance	✓
FORM- 4	Details of Foreign loans	NA
FORM- 4A	Details of Foreign Equity	NA
FORM-5	Abstract of Admitted Capital Cost for the existing Projects	✓
FORM-5(1) &5(2)	capitalisation details on Recommissioning of units.	✓
FORM- 6	Financial Package upto COD	NA
FORM- 7	Details of Project Specific Loans	NA
FORM- 8	Details of Allocation of corporate loans to various projects	✓
FORM-9A**	Summary of Statement of Additional Capitalisation claimed during the period	✓
FORM-9 ##	Statement of Additional Capitalisation after COD	✓
FORM- 10	Financing of Additional Capitalisation	✓
FORM- 11	Calculation of Depreciation on original project cost	NA
FORM- 12	Statement of Depreciation	✓
FORM- 13	Calculation of Weighted Average Rate of Interest on Actual Loans	✓
FORM- 14	Draw Down Schedule for Calculation of IDC & Financing Charges	NA
FORM- 15	Details of Fuel for Computation of Energy Charges	✓
FORM- 15A	Details of Seconday Fuel for Computation of Energy Charges	✓
FORM- 15B	Computation of Energy Charges	✓
FORM- 16	Details of Limestone for Computation of Energy Charge Rate	NA
FORM-17	Details of Capital Spares	***
FORM- 18	Non-Tariff Income	***
FORM-19	Details of Water Charges	***
FORM-20	Details of Statutory Charges	***

** Additional Forms
Provided yearwise for the period 2019-24
*** Shall be provided at the time of true up

PART-I

List of Supporting Forms / documents for tariff filing for Thermal Stations

Form No.	Title of Tariff Filing Forms (Thermal)	Tick
FORM-A	Abstract of Capital Cost Estimates	NA
FORM-B	Break-up of Capital Cost for Coal/Lignite based projects	NA
FORM-C	Break-up of Capital Cost for Gas/Liquid fuel based Projects	NA
FORM-D	Break-up of Construction/Supply/Service packages	NA
FORM-E	Details of variables , parameters , optional package etc. for New Project	NA
FORM-F	Details of cost over run	NA
FORM-G	Details of time over run	NA
FORM –H	Statement of Additional Capitalisation during end of the useful life	
FORM –I	Details of Assets De-capitalised during the period	***
FORM –J	Reconciliation of Capitalisation claimed vis-à-vis books of accounts	***
FORM –K	Statement showing details of items/assets/works claimed under Exclusions	***
FORM-L	Statement of Capital cost	✓
FORM-M	Statement of Capital Woks in Progress	✓
FORM-N	Calculation of Interest on Normative Loan	✓
FORM-O	Calculation of Interest on Working Capital	✓
FORM-P	Incidental Expenditure up to SCOD and up to Actual COD	NA
FORM-Q	Expenditure under different packages up to SCOD and up to Actual COD	NA
FORM-R	Actual cash expenditure	NA
FORM-S	Statement of Liability flow	✓
FORM-T	Summary of issues involved in the petition	✓

** Additional Forms
*** Shall be provided at the time of true up

List of supporting documents for tariff filing for Thermal Stations		
S. No.	Information / Document	Tick
1	Certificate of incorporation, Certificate for Commencement of Business, Memorandum of Association, & Articles of Association (For New Station setup by a company making tariff application for the first time to CERC)	NA
2	A. Station wise and Corporate audited Balance Sheet and Profit & Loss Accounts with all the Schedules & annexures on COD of the Station for the new station & for the relevant years.	*
	B. Station wise and Corporate audited Balance Sheet and Profit & Loss Accounts with all the Schedules & annexures for the existing station for relevant years.	NA
3	Copies of relevant loan Agreements	NA
4	Copies of the approval of Competent Authority for the Capital Cost and Financial package.	NA
5	Copies of the Equity participation agreements and necessary approval for the foreign equity.	NA
6	Copies of the BPSA/PPA with the beneficiaries, if any	NA
7	Detailed note giving reasons of cost and time over run, if applicable.	NA
	List of supporting documents to be submitted:	
	a. Detailed Project Report	
	b. CPM Analysis	
	c. PERT Chart and Bar Chart	
	d. Justification for cost and time Overrun	
8	Generating Company shall submit copy of Cost Audit Report along with cost accounting records, cost details, statements, schedules etc. for the Generating Unit wise /stage wise/Station wise/ and subsequently consolidated at Company level as submitted to the Govt. of India for first two years i.e. 2019-20 and 2020-21 at the time of mid-term true-up in 2021-22 and for balance period of tariff period 2019-24 at the time of final true-up in 2024-25. In case of initial tariff filing the latest available Cost Audit Report should be furnished.	*
9	Any other relevant information, (Please specify)	
10	Reconciliation with Balance sheet of any actual additional capitalization and amongst stages of a generating station	*
11	BBMB is maintaining the records as per the relevant applicable Acts. Formats specified herein may not be suitable to the available information with BBMB. BBMB may modify the formats suitably as per available information to them for submission of required information for tariff purpose.	NA

* Information will be provided at true-up.

PART-I
FORM- 1

Summary of Tariff

Name of the Petitioner:	**NTPC Limited**
Name of the Generating Station:	**Talcher Super Thermal Power Station Stage-I**
Place (Region/District/State):	**Eastern Region/ Talcher/ Odisha**

Amount in Rs. Lakhs

S. No.	Particulars	Unit	Existing 2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7	8	9
1.1	Depreciation	Rs Lakh	10,902.58	12,349.54	18,316.90	30,289.13	5,175.90	2,370.15
1.2	Interest on Loan	Rs Lakh	0.00	-	-	-	-	-
1.3	Return on Equity	Rs Lakh	26,836.73	25,174.96	25,893.90	26,630.58	17,613.33	17,740.10
1.4	Interest on Working Capital	Rs Lakh	5,825.09	5,550.95	5,708.77	5,957.11	5,501.31	5,519.77
1.5	O&M Expenses	Rs Lakh	22,836.11	26107.24	27197.46	28337.18	29521.36	30749.80
1.6	Special Allowance (If applicable)	Rs Lakh	0.00	0.00	0.00	1171.23	8315.75	9500.00
1.7	Compensation Allowance (If applicable – relevant for column 4 only)	Rs. Lakh	1,000.00	0.00	0.00	0.00	0.00	0.00
1.8	Unrecovered depreciation to be recovered at the end of useful life.	Rs. Lakh					580.49	
	Total	Rs Lakh	**67400.51**	**69182.68**	**77117.03**	**92385.22**	**66708.15**	**65879.82**
2.1	Landed Fuel Cost Domestic (coal/gas/RLNG/ liquid).	Rs/Ton	*1804.74*					
	(%) of Fuel Quantity	(%)						
2.2	Landed Fuel Cost Imported Coal .	Rs/Ton	6734.34					
	(%) of Fuel Quantity	(%)						
2.3	Landed Fuel Cost (coal/gas /RLNG/liquid) other than FSA	Rs/Ton	NA					
	(%) of Fuel Quantity	(%)						
2.4	Landed Fuel Cost Imported Coal other than FSA.		NA					
	(%) of Fuel Quantity							
2.5	Secondary fuel oil cost	Rs/Unit	0.021					
	Energy Charge Rate ex-bus (Paise/kWh)	Rs/Unit	**1.866**					

(Petitioner)

PART-I
FORM- 1(I)

Name of the Petitioner:	NTPC Limited
Name of the Generating Station:	Talcher Super Thermal Power Station Stage-I

Amount in Rs. Lakhs

Statement showing claimed capital cost – (A+B)

S. No.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7
1	Opening Capital Cost	276,244.18	282,856.18	302,633.18	309,868.18	314,135.18
2	Add: Addition during the year/period	6,612.00	19,777.00	7,235.00	4,267.00	1,000.00
3	Less: De-capitalisation during the year/period	-	-	-	-	-
4	Less: Reversal during the year / period	-	-	-	-	-
5	Add: Discharges during the year/ period	-	-	-	-	-
6	Closing Capital Cost	282,856.18	302,633.18	309,868.18	314,135.18	315,135.18
7	**Average Capital Cost**	**279,550.18**	**292,744.68**	**306,250.68**	**312,001.68**	**314,635.18**

Statement showing claimed capital cost eligible for RoE at normal rate (A)

S. No.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7
1	Opening Capital Cost	276244.18	282856.18	300788.18	308023.18	310623.18
2	Add: Addition during the year / period	6612.00	17932.00	7235.00	2600.00	1000.00
3	Less: De-capitalisation during the year / period	0.00	0.00	0.00	0.00	0.00
4	Less: Reversal during the year / period	0.00	0.00	0.00	0.00	0.00
5	Add: Discharges during the year / period	0.00	0.00	0.00	0.00	0.00
6	Closing Capital Cost	282856.18	300788.18	308023.18	310623.18	311623.18
7	**Average Capital Cost**	**279550.18**	**291822.18**	**304405.68**	**309323.18**	**311123.18**

Statement showing claimed capital cost eligible for RoE at weighted average rate of interest on actual loan portfolio (B)

S. No.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7
1	Opening Capital Cost	0.00	0.00	1845.00	1845.00	3512.00
2	Add: Addition during the year / period	0.00	1845.00	0.00	1667.00	0.00
3	Less: De-capitalisation during the year / period	0.00	0.00	0.00	0.00	0.00
4	Less: Reversal during the year / period	0.00	0.00	0.00	0.00	0.00
5	Add: Discharges during the year / period	0.00	0.00	0.00	0.00	0.00
6	Closing Capital Cost	0.00	1845.00	1845.00	3512.00	3512.00
7	**Average Capital Cost**	**0.00**	**922.50**	**1845.00**	**2678.50**	**3512.00**

(Petitioner)

PART-I
FORM- 1(IIA)

Name of the Petitioner:	NTPC Limited
Name of the Generating Station:	Talcher Super Thermal Power Station Stage-I

Statement showing Return on Equity at Normal Rate

Amount in Rs. Lakhs

S. No.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7
	Return on Equity					
1	Gross Opening Equity (Normal)	133,045.87	135,029.47	140,409.07	142,579.57	143359.5708
2	Less: Adjustment in Opening Equity	-				
3	Adjustment during the year		0.00	0.00	49619.12	49619.12
4	Net Opening Equity (Normal)	133,045.87	135,029.47	140,409.07	92,960.45	93,740.45
5	Add: Increase in equity due to addition during the year / period	1983.60	5379.60	2170.50	780.00	300.00
7	Less: Decrease due to De-capitalisation during the year / period	0.00	0.00	0.00	0.00	0.00
8	Less: Decrease due to reversal during the year / period	0.00	0.00	0.00	0.00	0.00
9	Add: Increase due to discharges during the year / period	0.00	0.00	0.00	0.00	0.00
10	Net closing Equity (Normal)	135,029.47	140,409.07	142,579.57	93,740.45	94,040.45
11	Average Equity (Normal)	134,037.67	137,719.27	141,494.32	93,350.45	93,890.45
12	Rate of ROE (%)	18.782	18.782	18.782	18.782	18.782
13	Total ROE	**25,174.96**	**25,866.43**	**26,575.46**	**17,533.08**	**17,634.51**

(Petitioner)

PART-I
FORM- 1(IIB)

Name of the Petitioner:	NTPC Limited
Name of the Generating Station:	Talcher Super Thermal Power Station Stage-I

Statement showing Return on Equity at weighted average rate of interest

Amount in Rs. Lakhs

S. No.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7
	Return on Equity (beyond the original scope of work excluding additional capitalization due to Change in Law)					
1	Gross Opening Equity	0.00	0.00	553.50	553.50	1053.60
2	Less: Adjustment in Opening Equity	0.00	0.00	0.00	0.00	0.00
3	Adjustment during the year	0.00	0.00	0.00	0.00	0.00
4	Net Opening Equity	0.00	0.00	553.50	553.50	1053.60
5	Add: Increase in equity due to addition during the year / period	0.00	553.50	0.00	500.10	0.00
7	Less: Decrease due to De-capitalisation during the year / period	0.00	0.00	0.00	0.00	0.00
8	Less: Decrease due to reversal during the year / period	0.00	0.00	0.00	0.00	0.00
9	Add: Increase due to discharges during the year / period	0.00	0.00	0.00	0.00	0.00
10	Net closing Equity	0.00	553.50	553.50	1053.60	1053.60
11	Average Equity	0.00	276.75	553.50	803.55	1053.60
12	Rate of ROE (%)	9.885	9.923	9.957	9.987	10.022
13	Total ROE	**0.00**	**27.46**	**55.11**	**80.25**	**105.59**

(Petitioner)

PART-I

FORM-2

Plant Characteristics

Name of the Petitioner	**NTPC Ltd.**	
Name of the Generating Station	**TSTPS Stage-I**	
Unit(s)/Block(s)/Parameters	**Unit-I**	**Unit-II**
Installed Capacity (MW)	500	500
Schedule COD as per Investment Approval	-	-
Actual COD /Date of Taken Over (as applicable)	01.01.1997	01.07.1997
Pit Head or Non Pit Head	Pit head	
Name of the Boiler Manufacture	M/s Stein Industries, France	
Name of Turbine Generator Manufacture	ABB, Germany	
Main Steams Pressure at Turbine inlet (kg/Cm^2) abs.	Not Applicable.	
Main Steam Temperature at Turbine inlet (^oC)		
Reheat Steam Pressure at Turbine inlet ($kg/Cm^{2)}$		
Reheat Steam Temperature at Turbine inlet (^oC)		
Main Steam flow at Turbine inlet under MCR condition (tons /hr)^2		
Main Steam flow at Turbine inlet under VWO condition (tons /hr)^2		
Unit Gross electrical output under MCR /Rated condition (MW)		
Unit Gross electrical output under VWO condition (MW)		
Guaranteed Design Gross Turbine Cycle Heat Rate (kCal/kWh)		
Conditions on which design turbine cycle heat rate guaranteed		
% MCR	Not Applicable.	
% Makeup Water Consumption		
Design Capacity of Make up Water System		
Design Capacity of Inlet Cooling System		
Design Cooling Water Temperature (^0C)		
Back Pressure		
Steam flow at super heater outlet under BMCR condition (tons/hr)		
Steam Pressure at super heater outlet under		
BMCR condition) kg/Cm^2		
Steam Temperature at super heater outlet under		
BMCR condition (^0C)		
Steam Temperature at Reheater outlet at BMCR condition (^0C)		
Design / Guaranteed Boiler Efficiency (%)		
Design Fuel with and without Blending of domestic/imported coal		
Type of Cooling Tower	IDCT	
Type of cooling system	Closed ckt cooling	
Type of Boiler Feed Pump	2 Nos Turbine driven and one no motor driven	
Fuel Details		
-Primary Fuel	Coal	
-Secondary Fuel	HFO	
-Alternate Fuels	NA	
Special Features/Site Specific Features	Tube mills in place of Pressurised Bowl Mill.	
Special Technological Features	Subcritical once through boiler	
Environmental Regulation related features	ESP	
Any other special features		

Petitioner

PART-I
FORM- 3

Normative parameters considered for tariff computations

Name of the Petitioner:	**NTPC Limited**
Name of the Generating Station:	**Talcher Super Thermal Power Station Stage-I**

(Year Ending March)

Particulars	Unit	Existing 2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7	8
Base Rate of Return on Equity $$	%	15.50	15.50	15.50	15.50	15.50	15.50
Base Rate of Return on Equity on Add. Capitalization** $$	%	-	8.157	8.189	8.217	8.242	8.271
Effective Tax Rate	%	21.4588	17.4720	17.4720	17.4720	17.4720	17.4720
Target Availability	%	85.00	85.00				
In High Demand Season	%	-	-	85.00	85.00	85.00	85.00
Peak Hours	%	-	-	85.00	85.00	85.00	85.00
Off-Peak Hours	%	-	-	85.00	85.00	85.00	85.00
In Low Demand Season(Off-Peak)	%	-	-	85.00	85.00	85.00	85.00
Peak Hours	%	-	-	85.00	85.00	85.00	85.00
Off-Peak Hours	%	-	-	85.00	85.00	85.00	85.00
Auxiliary Energy Consumption	%	5.75	7.05	7.05	7.05	7.05	7.05
Gross Station Heat Rate	kCal/kWh	2375.00	2390.00	2390.00	2390.00	2390.00	2390.00
Specific Fuel Oil Consumption	ml/kWh	0.50	0.50	0.50	0.50	0.50	0.50
Cost of Coal/Lignite for WC	in Days	45	40	40	40	40	40
Cost of Main Secondary Fuel Oil for WC	in Months	2	2	2	2	2	2
Fuel Cost for WC	in Months						
Liquid Fuel Stock for WC	in Months						
O&M Expenses	Rs lakh/MW	20.43	22.51	23.3	24.12	24.97	25.84
Maintenance Spares for WC	% of O&M	20.00	20.00	20.00	20.00	20.00	20.00
Receivables for WC	in Days	60	45	45	45	45	45
Storage capacity of Primary fuel	Lakh MT	2.66					
SBI 1 Year MCLR plus 350 basis point	%	13.50	12.05	12.05	12.05	12.05	12.05
Blending ratio of domestic coal/imported coal							

** Rate of Return on Add - cap beyond original scope and excluding Change in Law

$$ Additional RoE due to better ramp rate would be claimed at the time of true-up or as per guidelines to be issued

Petitioner

Part-I
FORM-3A
ADDITIONAL FORM

Calculation of O&M Expenses

Name of the Company :	**NTPC Limited**
Name of the Power Station :	**Talcher Super Thermal Power Station Stage-I**

Amount in Rs. Lakhs

S.No.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	7	8
1	**O&M expenses under Reg.35(1)**					
1a	Normative	22510.00	23300.00	24120.00	24970.00	25840.00
2	**O&M expenses under Reg.35(6)**					
2a	Water Charges *	2281.67	2450.33	2625.33	2800.33	2983.67
2b	Security expenses*	1315.57	1447.13	1591.84	1751.03	1926.13
2c	Capital Spares**	0.00	0.00	0.00	0.00	0.00
3	O&M expenses-Ash Transportation**	0.00	0.00	0.00	0.00	0.00
	Total O&M Expenses	**26107.24**	**27197.46**	**28337.18**	**29521.36**	**30749.80**

*Subject to true-up

** Shall be provided at the time of truing up

Petitioner

PART-I
FORM-3B
Additional Form

Computation of Special Allowance

Name of the Company :	NTPC Limited
Name of the Power Station :	Talcher Super Thermal Power Station Stage-I
Rate of Special allowance @lakh/MW/year	9.5

(Rs. Lakh)

Unit No.	Capacity (MW)	Date of COD	Year of completion of useful life of 25 yrs.	Special Allowance as per Clause 28					
				Existing 2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
1	500	01.01.1997		0.00			1171.23	4750.00	4750.00
2	500	01.07.1997		0.00			0.00	3565.75	4750.00
Year wise Total for the Station				**0.00**	**0.00**	**0.00**	**1171.23**	**8315.75**	**9500.00**

Petitioner

Form-4

Form-4

DETAILS OF FOREIGN LOANS

(Details only in respect of loans applicable to the project under petition)

Name of the company		NTPC LIMITED				
Name of the Power Station		Talcher STPP-ESP				
Exchange Rate as on	31-03-2019	USD = Rs.	69.77	EUR = Rs.	78.84	JPY	0.6343

2.95% (Amount in Lacs) (Amount in Lacs) (Amount in Lacs)

Financial Year (Starting from COD)	2019-20 (01.04.2019 to 31.03.2020)				2020-21 (01.04.2020 to 31.03.2021)				2021-22 (01.04.2021 to 31.03.2022)			
1	1	2	3	4	1	2	3	4	1	2	3	4
KfW -ESP	Date	Amount (FC)	Ex. Rate	Amount (INR)	Date	Amount (FC)	Ex. Rate	Amount (INR)	Date	Amount (FC)	Ex. Rate	Amount (INR)
Currency 1 EURO	15-03-2019											
At the date of drawl	01-04-2019	28.07	78.84	2,213.11	01-04-2020	28.07	78.84	2,213.11	01-04-2021	28.07	78.84	2,213.11
Loan repayment upto previous period		7.02	78.84	553.28		10.53				14.04		
Net loan at the Beginning of the period	01-04-2019	21.05	78.84	1,659.83	01-04-2020	17.54	78.84	1,383.19	01-04-2021	14.04	78.84	1,106.56
Schedule repayment date of principal	15-09-2019	1.75	78.84	138.32	15-09-2020	1.75	78.84	138.32	15-09-2021	1.75	78.84	138.32
Scheduled payment date of interest	15-09-2019	0.34	78.84	26.47	15-09-2020	0.28	78.84	22.06	15-09-2021	0.22	78.84	17.65
Witholding tax including surcharge on interest	15-09-2019	-	78.84	-	15-09-2020	-	78.84	-	15-09-2021	-	78.84	-
Schedule repayment date of principal	15-03-2020	1.75	78.84	138.32	15-03-2021	1.75	78.84	138.32	15-03-2022	1.75	78.84	138.32
Scheduled payment date of interest	15-03-2020	0.31	78.84	24.27	15-03-2021	0.25	78.84	19.86	15-03-2022	0.20	78.84	15.44
Witholding tax including surcharge on interest	15-03-2020	-	78.84	-	15-03-2021	-	78.84	-	15-03-2022	-	78.84	-
At the end of Financial year	31-03-2020	17.54	78.84	1,383.19	31-03-2021	14.04	78.84	1,106.56	31-03-2022	10.53	78.84	829.92

(Amount in Lacs)

2022-23 (01.04.2022 to 31.03.2023)				2023-24 (01.04.2023 to 31.03.2024)			
1	2	3	4	1	2	3	4
Date	Amount (FC)	Ex. Rate	Amount (INR)	Date	Amount (FC)	Ex. Rate	Amount (INR)
01-04-2022	28.07	78.84	2,213.11	01-04-2023	28.07	78.84	2,213.11
	17.54				21.05		
01-04-2022	10.53	78.84	829.92	01-04-2023	7.02	78.84	553.28
15-09-2022	1.75	78.84	138.32	15-09-2023	1.75	78.84	138.32
15-09-2022	0.17	78.84	13.24	15-09-2023	0.11	78.84	8.82
15-09-2022	-	78.84	-	15-09-2023	-	78.84	-
15-03-2023	1.75	78.84	138.32	15-03-2024	1.75	78.84	138.32
15-03-2023	0.14	78.84	11.03	15-03-2024	0.08	78.84	6.62
15-03-2023	-	78.84	-	15-03-2024	-	78.84	-
31-03-2023	7.02	78.84	553.28	31-03-2024	3.51	78.84	276.64

3.51

KFW ESP Loan

Particulars			
Source of Loan	KFW ESP I	KfW ESP II	KfW ESP IX
Drawal	5,000,000.00	7,000,000.00	10,000,000.00
Currency	EUR	EUR	EUR
Amount of loan sanctioned			
Amount of Gross Loan drawn upto 31.03.2019			
Interest Type	Fixed	Fixed	Fixed
Fixed Interest Rate, if applicable	3.19%	3.19%	3.19%
Base Rate, if floating interest	-	-	-
Margin, if floating interest rate	-	-	-
Are there any Caps / Floor	NO	NO	NO
If above is Yes, specify Caps / Floor	-	-	-
Moratorium Period	4 Years 2½ Months	4 Years 2½ Months	4 Years 2½ Months
Moratorium effective from			
Repayment period	Repayment in 8 Years (16 semi-annual instalments)	Repayment in 8 Years (16 semi-annual instalments)	Repayment in 8 Years (16 semi-annual instalments)
Repayment effective from	15.09.2017	15.09.2017	15.09.2017
Repayment frequency			
Repayment installment			
Base Exchange Rate (31.03.2019)			
Are foreign currency loan hedged			
If above is Yes, specify details	NO	NO	NO
Drawl Date	10.12.13	14.02.14	17.08.15
Drawl Exchange Rate	83.97569	85.01401	72.34003
Name of the Projects			
Anantpur Solar			12.19552%
Farakka ESP			10.57396%
Korba STPS- ESP	76.00000%	37.34753%	22.65206%
Rihand-I ESP			41.60665%
Singrauli I & II ESP			2.82990%
Talcher STPP-ESP	24.00000%	18.91575%	0.49892%
TTPS -II ESP		5.49912%	4.83787%
Unchahar-I ESP			4.80512%
VSTPP I & II ESP		38.23760%	**100.00000%**
Total	**100.00000%**	**100.00000%**	

PART 1
FORM- 5

Abstract of Admitted Capital Cost for the existing Projects

Name of the Company :	**NTPC Limited**
Name of the Power Station :	**Talcher Super Thermal Power Station Stage-I**

Last date of order of Commission for the project	**Date (DD-MM-YYYY)**	29-07-16
Reference of petition no. in which the above order was passed	**Petition no.**	281/GT/2014
Following details (whether admitted and /or considered) as on the last date of the period for which tariff is approved, in the above order by the Commission:		
Capital cost (cash basis)	**(Rs. in lakh)**	286719.15
Amount of un-discharged liabilities included in above (& forming part of admitted capital cost)		0
Amount of un-discharged liabilities corresponding to above admitted capital cost (but not forming part of admitted capital cost being allowed on cash basis)		637.33
Gross Normative Debt		150530.78
Cumulative Repayment		150530.78
Net Normative Debt		0
Normative Equity		136188.36
Cumulative Depreciation		220687.94
Freehold land		2831.54

(Petitioner)

PART 1
FORM- 5A

Abstract of Claimed Capital Cost for the existing Projects

Name of the Company :	**NTPC Limited**
Name of the Power Station :	**Talcher Super Thermal Power Station Stage-I**

Reference of Final True-up Tariff Petition	**Affidavit dated**	13.01.2020
Capital Cost as on 31.03.2019 as per Hon'ble Commission's Order dated	**Rs. Lakhs**	286719.15
(-) Adjustment as per Para (7) of this petition		-10474.97
Following details as considered by the Petitioner as on the last date of the period for which final true-up tariff is claimed:		
Capital cost as on 01.04.2019	**(Rs. in lakh)**	276244.18
Amount of un-discharged liabilities included in above (& forming part of admitted capital cost)		0.00
Amount of un-discharged liabilities corresponding to above admitted capital cost (but not forming part of admitted capital cost being allowed on cash basis)		3234.24
Gross Normative Debt		143198.31
Cumulative Repayment		143198.31
Net Normative Debt		0.00
Normative Equity		133045.87
Cumulative Depreciation		212121.66
Freehold land		2831.54

(Petitioner)

Form 8- Domestic Bonds- Details of Allocation of corporate loans to various projects during the FY 2014-19

Particulars	54	57
Source of Loan1	BONDS	BONDS
Currency2	INR	INR
Amount of Loan sanctioned	1030683	50000
Interest Type6	Fixed	Fixed
Fixed Interest Rate, if applicable	8.49%	8.19%
Base Rate, if Floating Interest7	N/A	N/A
Margin, if Floating Interest8	N/A	N/A
Are there any Caps/Floor9	No	No
If above is yes,specify caps/floor	N/A	N/A
Moratorium Period10	8	10
Moratorium effective from #	25-03-15	15-12-15
Repayment Period11	Installments Due on 25/03/2023, 25/03/2024 & 25/03/2025	Bullet Repayment
Repayment effective from	25-03-23	15-12-25
Repayment Frequency12	Installments Due on 25/03/2023, 25/03/2024 & 25/03/2025	Bullet Repayment
Repayment Instalment13,14	Installments 1st - 206,136.61 2nd - 412,273.22 3rd - 412,273.22	50000
Base Exchange Rate16	N/A	N/A
Door to Door Maturity	10	10

Name of the Projects		
Anantpur Solar	5,600	-
Auraiya R & M	-	1,400
Badarpur R&M	2,300	-
BARH I	74,883	8,900
BARH II	63,500	-
BONGAIGAON	54,000	500
Chatti Bariatu CMB	8,100	-
Dadri Gas R & M	600	-
DARLIPALLI	49,200	-
FARAKKA III	10,900	-
Farakka R & M	2,000	-
GADARWARA	81,000	2,000
Gandhar R &M	4,300	800
Kahalgaon II Phase II	1,800	-
Khstpp R & M	2,000	500
Kawas R & M	1,400	-
Khargone	45,000	3,000
KOLDAM	25,100	3,700
KORBA III	9,200	500

Korba R & M	4,400	-
Kudgi	123,300	-
LARA I	53,300	13,700
Lata Tapovan	1,600	-
Mauda	21,900	-
Mauda II	45,800	-
NCTPP II	11,000	500
NCTPP R & M	3,700	-
NORTH KARANPURA	12,400	-
Pakri Barwadih CMB	26,600	800
Ramagundam I & II R & M	2,400	-
Rammam	3,100	-
RIHAND III	28,300	800
Rihand R & M	2,500	-
Simhadari II	26,800	1,000
Simhadari R & M	900	-
Vidhyachal Hydro**	1,900	-
Singrauli R & M	1,600	-
Vindyachal Solar**	4,800	-
SIPAT I	20,500	1,400
SOLAPUR	70,300	-
TALCHER II	12,000	700
Tanda II	9,000	400
Tapovan Vishnugad	26,400	-
TSTPP R & M	1,600	1,000
TTPS R & M	1,000	-
Unchahar R & M	3,400	-
Unchahar IV	17,400	4,800
Vindhyachal IV	17,200	500
Vindhyachal V	33,500	2,200
Vindhyachal R & M	1,200	900
CC		
TOTAL	**1,030,683**	**50,000**

Statement Giving Details of Project Financed through a Combination of loan

Form 8

TRANCHE NO

BP NO 5050000261 T00001 D00007

Unsecured Loan From SBI-VII		
Source of Loan :	SBI-VII	
Currency :	INR	
Amount of Loan :	100,000,000,000	
Total Drawn amount :	5,000,000,000	
Date of Drawl	0	
Interest Type :	Floating	
Rate of Interest as on 01.04.2019	8.25%	
Upfront fees	0.08% excluding service tax	
Margin, If Floating Interest :	Nil	
Are there any Caps/ Floor :	Y/N	
Frequency of Intt. Payment	Monthly	
If Above is yes, specify Caps/ Floor :		
Moratorium Period :	4 Years	
Moratorium effective from :	08.07.2011	
Repayment Period (Inc Moratorium) :	12 Years	
Repayment Frequency :	16 Half Yearly Instalments	
Repayment Type :	AVG	
First Repayment Date :	30.09.2015	
Base Exchange Rate :	RUPEE	
Date of Base Exchange Rate :	N.A.	
Project Code	Project Name	Amount
	KOLDAM	350,000,000
	SOLAPUR	250,000,000
	VINDHYACHAL-IV	200,000,000
	TAPOVAN	200,000,000
	BARH-I	800,000,000
	MOUDA-I	150,000,000
	RIHAND-III	450,000,000
	KUDGI-I	200,000,000
	DADRI SOLAR PV	50,000,000
	A&N SOLAR PV	50,000,000
	SINGARULI 8 MW	50,000,000
	BONGAIGAON	400,000,000
	BARH-II	800,000,000
	SINGRAULI-R&M	250,000,000
	TANDA - R&M	150,000,000
	KAWAS-R&M	350,000,000
	GANDHAR -R&M	200,000,000
	TSTPP-R&M	100,000,000
Total Allocated Amount		5,000,000,000.00

Form 8

TRANCHE NO

BP NO 5050000261 T00001 D00008

Unsecured Loan From SBI-VII		
Source of Loan :	SBI-VII	
Currency :	INR	
Amount of Loan :	100,000,000,000	
Total Drawn amount :	5,000,000,000	
Date of Drawl	0	
Interest Type :	Floating	
Rate of Interest as on 01.04.2019	8.25%	
Upfront fees	0.08% excluding service tax	
Margin, If Floating Interest :	Nil	
Are there any Caps/ Floor :	Y/N	
Frequency of Intt. Payment	Monthly	
If Above is yes, specify Caps/ Floor :		
Moratorium Period :	4 Years	
Moratorium effective from :	08.07.2011	
Repayment Period (Inc Moratorium) :	12 Years	
Repayment Frequency :	16 Half Yearly Instalments	
Repayment Type :	AVG	
First Repayment Date :	30.09.2015	
Base Exchange Rate :	RUPEE	
Date of Base Exchange Rate :	N.A.	
Project Code	Project Name	Amount
	KOLDAM	350,000,000
	SOLAPUR	300,000,000
	VINDHYACHAL-V	380,000,000
	TAPOVAN	180,000,000
	BARH-I	570,000,000
	MOUDA-II	260,000,000
	RIHAND III	320,000,000
	KUDGI-I	380,000,000
	DADRI SOLAR PV	190,000,000
	A&N SOLAR PV	200,000,000
	LARA-I	200,000,000
	BONGAIGAON	340,000,000
	FARAKKA-III	270,000,000
	SIMHADRI-II	200,000,000
	SINGRAULI-R&M	100,000,000
	TTPS-R&M	150,000,000
	KAWAS-R&M	150,000,000
	GANDHAR-R&M	80,000,000
	TSTPP-R&M	100,000,000
	RAMAGUNDAM-R&M	80,000,000
	BADARPUR-R&M	200,000,000
Total Allocated Amount		**5,000,000,000.00**

Statement Giving Details of Project Financed through a Combination of loan

Form 8

TRANCHE NO **T00001** **D00012**

BP NO 5050000261

Unsecured Loan From SBI-VII		
Source of Loan :	SBI-VII	
Currency :	INR	
Amount of Loan :	100,000,000,000	
Total Drawn amount :	2,500,000,000	
Date of Drawl	0	
Interest Type :	Floating	
Rate of Interest as on 01.04.2019	8.25%	
Upfront fees	0.08% excluding service tax	
Margin, If Floating Interest :	Nil	
Are there any Caps/ Floor :	Y/N	
Frequency of Intt. Payment	Monthly	
If Above is yes, specify Caps/ Floor :		
Moratorium Period :	4 Years	
Moratorium effective from :	08.07.2011	
Repayment Period (Inc Moratorium) :	12 Years	
Repayment Frequency :	16 Half Yearly Instalments	
Repayment Type :	AVG	
First Repayment Date :	30.09.2015	
Base Exchange Rate :	RUPEE	
Date of Base Exchange Rate :	N.A.	
Project Code	Project Name	Amount
	BARH-II	670,000,000
	FARAKKA-III	350,000,000
	SIMHADRI-II	200,000,000
	RAMAGUNDAM SOLAR	100,000,000
	FGUTPS-I	84,009,477
	FGUTPS-II	55,990,523
	VSTPS R&M	280,000,000
	RAMAGUNDAM-R&M	180,000,000
	KORBA-R&M	170,000,000
	KAWAS-R&M	170,000,000
	BADARPUR-R&M	140,000,000
	TSTPP-R&M	100,000,000
Total Allocated Amount		**2,500,000,000.00**

Statement Giving Details of Project Financed through a Combination of loan

Form 8

TRANCHE NO

BP NO 5050000442 **T00001** D0001

Unsecured Loan From SBI-VIII		
Source of Loan :	SBI-VIII	
Currency :	INR	
Amount of Loan :	100,000,000,000	
Total Drawn amount :	5,000,000,000	
Interest Type :	Floating	
Fixed Interest Rate :	----------	
Base Rate, If Floating Interest	D0001-3-8.25%	
Margin, If Floating Interest :		
Are there any Caps/ Floor :	Y/N	
Frequency of Intt. Payment	Monthly	
If Above is yes, specify Caps/ Floor :		
Moratorium Period :	6 Years	
Moratorium effective from :	21.01.2015	
Repayment Period (Inc Moratorium) :	15 Years	
Repayment Frequency :	9 Yearly Installments	
Repayment Type :	AVG	
First Repayment Date :	31.01.2022	
Base Exchange Rate :	RUPEE	
Date of Base Exchange Rate :	N.A.	
Project Code	**Project Name**	**Amount**
	BARH-I	1,000,000,000
	FARAKKA R&M	250,000,000
	TSTPP R&M	400,000,000
	SINGRAULI R&M	400,000,000
	RAMAGUNDAM R&M	500,000,000
	KAWAS R&M	600,000,000
	KORBA R&M	600,000,000
	GANDHAR R&M	1,250,000,000
Total Allocated Amount		**5,000,000,000.00**

Statement Giving Details of Project Financed through a Combination of loan

Form 8

BP NO 5050000531	TRANCHE NO T00001	D0009
Unsecured Loan From SBI-IX		
Source of Loan :	SBI-IX	
Currency :	INR	
Amount of Loan :	30,000,000,000	
Total Drawn amount :	2,000,000,000	
Date of Drawal:	27.06.2018	
Interest Type :	Floating	
Fixed Interest Rate :	----------	
Base Rate, If Floating Interest	8.25%	
Margin, If Floating Interest :	0.00%	
Are there any Caps/ Floor :	Y/N	
Frequency of Intt. Payment	Monthly	
If Above is yes, specify Caps/ Floor :		
Moratorium Period :	3 Years	
Moratorium effective from :	27.06.2018	
Repayment Period (Inc Moratorium) :	12 Years	
Repayment Frequency :	9 Yearly Installments	
Repayment Type :	AVG	
First Repayment Date :	31.03.2021	
Base Exchange Rate :	RUPEE	
Date of Base Exchange Rate :	N.A.	
Project Code	**Project Name**	**Amount**
	BARH-I	250,000,000
	TANDA II	300,000,000
	TELANGANA	300,000,000
	RAMAGUNDAM R&M	250,000,000
	TALCHER STPP R&M	400,000,000
	KAHALGAON R&M	200,000,000
	PAKRI BARWADIH CMB	300,000,000
Total Allocated Amount		**2,000,000,000.00**

Statement Giving Details of Project Financed through a Combination of loan

Form 8

BP NO 5050000442	TRANCHE NO T00001	D18
Unsecured Loan From SBI-VIII		
Source of Loan :	SBI-VIII	
Currency :	INR	
Amount of Loan :	100,000,000,000	
Total Drawn amount :	1,500,000,000	
Date of Drawl	0	
Interest Type :	Floating	
Fixed Interest Rate :	----------	
Base Rate, If Floating Interest	D00018-8.25%	
Margin, If Floating Interest :	0.00%	
Are there any Caps/ Floor :	Y/N	
Frequency of Intt. Payment	Monthly	
If Above is yes, specify Caps/ Floor :		
Moratorium Period :	6 Years	
Moratorium effective from :	21.04.2016	
Repayment Period (Inc Moratorium) :	15 Years	
Repayment Frequency :	9 Yearly Installments	
Repayment Type :	AVG	
First Repayment Date :	31.01.2022	
Base Exchange Rate :	RUPEE	
Date of Base Exchange Rate :	N.A.	
Project Code	**Project Name**	**Amount**
	BONGAIGAON	700,000,000
	UNCHAHAR-IV	50,000,000
	RAMAGUNDAM R&M	150,000,000
	TSTPS R&M	210,000,000
	GANDHAR R&M	80,000,000
	KORBA R&M	60,000,000
	DADRI GAS R&M	100,000,000
	UNCHAHAR R&M	50,000,000
	BADARPUR R&M	50,000,000
	KAHALGAON R&M	50,000,000
Total Allocated Amount		**1,500,000,000**

Statement Giving Details of Project Financed through a Combination of loan

Form 8

BP NO 5050000521	TRANCHE NO T00001	D00004
Unsecured Loan From HDFC Bank Ltd.-IV		
Source of Loan :	HDFC Bank Ltd.-IV	
Currency :	INR	
Amount of Loan :	20,000,000,000	
Total Drawn amount :	12,450,000,000	
Date of drawl	29.06.2018	
Interest Type :	Floating	
Fixed Interest Rate :		
Base Rate, If Floating Interest	8.45%	
Margin, If Floating Interest :	NIL	
Are there any Caps/ Floor :	Y/N	
Frequency of Intt. Payment	MONTHLY	
If Above is yes, specify Caps/ Floor :		
Moratorium Period :	3 Years	
Moratorium effective from :	29.06.2018	
Repayment Period (Inc Moratorium) :	12 Years	
Repayment Frequency :	9 Yearly Instalment	
Repayment Type :	AVG	
First Repayment Date :	17.04.2021	
Base Exchange Rate :	RUPEE	
Date of Base Exchange Rate :	N.A.	
Project Code	Project Name	Amount
	KORBA R&M	900,000,000
	RAMAGUNDAM R&M	2,200,000,000
	UNCHAHAR R&M	700,000,000
	RIHAND R&M	900,000,000
	KAWAS R&M	1,800,000,000
	AURAIYA R&M	1,800,000,000
	TSTPP R&M	900,000,000
	GANDHAR R&M	1,850,000,000
	NCTPP R&M	300,000,000
	KAHALGAON R&M	300,000,000
	ANTA R&M	800,000,000
Total Allocated Amount		12,450,000,000

PART-I
FORM- 9A
Additional Form

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	NTPC Limited
Name of the Generating Station	Talcher Super Thermal Power Station Stage-I
COD	7/1/1997
For Financial Year	2019-24 (Summary)

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)						Justification	Admitted Cost by the Commission, if any
		2019-20	2020-21	2021-22	2022-23	2023-24	Total		
1	2	3	4	5	6	7		8	9
A.	**Works under Original scope, Change in Law etc. eligble for RoE at Normal Rate**								
I	Original scope works of Ash dyke and Ash handling	6207.00	14934.00	6300.00	1000.00	1000.00	29441.00	Provided in respective Form 9	
II	Works under compliance of existing law.		546.00	0.00	0.00	0.00	546.00		
III	Work towards safety and security	405.00	2400.00	800.00	1000.00	0.00	4605.00		
IV	Work due to Obsolescence of technology.		52.00	135.00	600.00				
	Total (A)	**6,612.00**	**17,932.00**	**7,235.00**	**2,600.00**	**1,000.00**	**34,592.00**		
B.	**Works beyond Original scope exluding add-cap due to Change in Law eligble for RoE at Wtd. Average rate of Interest**								
I	Construction of New ash dyke		1667.00		1667.00	0.00	3334.00		
II	Township Building work	0.00	178.00	0.00		0.00	178.00	Provided in respective Form 9	
	Total (B)	**0.00**	**1845.00**	**0.00**	**1667.00**	**0.00**	**3512.00**		
Total Add. Cap. Claimed (A+B)		**6612.00**	**19777.00**	**7235.00**	**4267.00**	**1000.00**	**38891.00**		

(Petitioner)

PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	NTPC Limited
Name of the Generating Station	Talcher Super Thermal Power Station Stage-I
COD	7/1/1997
For Financial Year	2019-20

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
A.	**Works under Original scope, Change in Law etc. eligble for RoE at Normal Rate**							
I	**Ash dyke raising &Strengthening works.**							
1	Ash dyke works of Lagoon 1 (including Raising & strengthening).	3700.00		**3700.00**		25(1)(c)	At TSTPS-I the actual annual ash production has been around 26.5 lakh cum as against estimated disposal of 14.4 lakh cum during initial design stage due to poor coal quality. Moreover the ash utilization too remained low despite the best of efforts. In order to create extra space in the existing dyke, NIT Rourkela was engaged as consultant for examining the feasibility of enhancement of dyke capacity. As the ultimate/ final raising (up to 7th raising) has already been exhausted , in both the lagoons of Stage-I, to accommodate the excess ash production as well as to strengthen the ash dyke buttressing work as per recommendation of the consultant NIT Rourkela are being taken up. The ash dyke raising works for Lagoon-I and Lagoon-II were allowed by Hon'ble Commission in 2014-19 vide order dtd 30.07.2016 in Petition No. 281/GT/2014. The buttressing/strengthening works were allowed for Lagoon-I and for Lagoon-II Hon'ble Commission had given liberty for considering the same at the time of true-up of 2014-19 tariff based on expert advice. The buttressing works of Lagoon-I were started by petitioner in 2014-19 and has been claimed in 2014-19 in tariff. The balance works of buttressing / strengthening of Lagoon-I are projected in tariff now in 2019-24. The works of Lagoon-2 could not be started in 2014-19 due to delay in finalising of expert advice report for carrying out these works. The same have been finalised now (copy attached at **Annexure-A**) and buttressing works of Lagoon-II are now projected for capitalisation in 2019-24. Hon'ble Commission may be pleased to allow the same.	Rs 100.5 Cr allowed during 2014-19 for ash dyke raising and stregthening works of Lagoon-1 in order dated 30.07.2016 in Pet No 281/GT/2014
2	Ash dyke works of Lagoon 2 (Including Raising)	1900.00		**1900.00**		25(1)(c) &(g)		Rs 33.52 Cr allowed during 2014-19 for ash dyke raising works of Lagoon-2 in order dated 30.07.2016 in Pet No 281/GT/2014.
3	4th pump in ash slurry series	607.00		**607.00**		25(1)(c) &(g)	This is part of Original scope of ash dyke and ash handling related works. The pumps is required to increase the pumping power for carrying ash slurry to ash dyke with increasing height. The work was allowed by Hon'ble Commission in 2014-19 period in order dtd 30.07.2016 in Pet No 281/GT/2014. The 4th slurry pump was awarded to M/s Indure, due to slow pace of work, the work could not be completed in the period 2014-19. However the work is going to be completed in the FY 2019-20 and hence has been put in the period 2019-24 for capitalisation. Hon'ble Commission may be pleased to allow the same.	Rs 6.30 Cr allowed during 2014-19 order dated 30.07.2016 in Pet No 281/GT/2014.
	SUB Total I	**6207.00**		**6207.00**				

PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	**NTPC Limited**
Name of the Generating Station	**Talcher Super Thermal Power Station Stage-I**
COD	**7/1/1997**
For Financial Year	**2019-20**

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
II	**Works towards safety and security.**							
1	Track MGR (7km)	405.00		**405.00**		25(2)(b) &(c)	The MGR track of TSTPS-I was laid 20 years back and have outlived their normal life. Replacement of 52kg rails and sleepers by 60kg rails and sleepers is required so as to avoid derailment. For speed increase in MGR track railway has recommended to use 60 kg sleepers of latest design in Indian Railway track (Copy of Railway Circular regarding same is attached at **Annexure-B**). In line with Railway circular, upgradation work is planned for MGR track of TSTPS-I . In view of above Hon'ble Commission may be pleased to allow the same.	
	SUB Total II	405.00		**405.00**				
Total Add. Cap. Claimed		6,612.00		**6,612.00**				

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PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	**NTPC Limited**
Name of the Generating Station	**Talcher Super Thermal Power Station Stage-I**
COD	**7/1/1997**
For Financial Year	**2020-21**

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
A.	**Works under Original scope, Change in Law etc. eligble for RoE at Normal Rate**							
I	**Ash dyke raising &Strengthening works.**							
1	Ash dyke works of Lagoon 2 (Including Raising)	7700.00		7700		25(1)(c) &(g)	Balance capitalisation , justification provided in Form 9 2019-20	Rs 33.52 Cr allowed during 2014-19 for ash dyke raising works of Lagoon-2 in order dated 30.07.2016 in Pet No 281/GT/2014.
2	Mine void filling through lean slurry system	2700		2700		26(1)(b) &(e)	SPCB in their consent dtd 31.01.2012 and 19.08.2014 had directed as a special conditions of consent to expedite the project for disposal of ash in the allotted mines voids of Jaganath OCP of MCL for achieving 100% ash utilisation as per MOEF guidelines of 2009. The work was projected during 2017-18 , pending MOEF clearance for the work which was pending at that time. Hon'ble Commission based on all documents and justifications had allowed to consider the work at the time of true-up of 2014-19 tariff subject to MOEF clearance. The mine void package that was envisaged to get completed in the period 2014-19 but got delayed due to the delay in receiving of statutory clearances and also signing of MOUs with MCL regarding the area through which the pipes are to be laid. MOEF clearance has now been granted vide minutes of 4th Expert appraisal committee (EAC) of MOEF held on 16.03.2017 (Point 4.7, copy of minutes attached as **Annexure-C**). As the project was taking time a pilot project was taken up for a single pipe line disposal to the mine void, the work progress of the same is considerable and is envisaged to get completed by FY 2020-21. Hon'ble Commission may be pleased to allow the same.	

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PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	**NTPC Limited**
Name of the Generating Station	**Talcher Super Thermal Power Station Stage-I**
COD	**7/1/1997**
For Financial Year	**2020-21**

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5=.(3-4)	6	7	8	9
3	Dry Ash evacuation system Stage-I	4500		4500		26(1) (b)&(e)	As per MOEF gazette notification on ash utilization dated 03.11.2009, station has to achieve 100% ash utilization in stipulated time frame. Further 20% ESP dry fly ash has to be kept reserve for issue to fly ash brick manufacturing units. Present DAES capacity is barely sufficient to meet its requirement. Augmentation of DAES of Stage-I units is required for increasing ash utilization percentage. Hon'ble Commission has allowed Dry ash evacuation system for stgae-II in 2014-19 tariff order dtd 16.02.2017 in Pet No 293/GT/2014. The work is also required as per SPCB consent guidelines to operate station. Latest SPCB consent dtd 27.03.2019 also mentions the same at Point F1-7&9 (relevant pages copy atached at **Annexure-D**). In view of above Hon'ble Commission may be pleased to allow the same.	
4	Weigh bridge for Ash Utilization.	34		34			As per MOEF gazzette notification on ash utilization dated 03.11.2009, station has to achieve 100% ash utilization in stipulated time frame. In tune of it, pond ash is being used by NHAI in its road construction projects, so as to facilitate the above in-motion weigh bridge is to be installed. The work is required to meet 100% ash utilisation targets of MoEF, Hon'ble Commission may be pleased to allow same.	
	SUB Total I	**14934**		**14934**				

PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	**NTPC Limited**
Name of the Generating Station	**Talcher Super Thermal Power Station Stage-I**
COD	**7/1/1997**
For Financial Year	**2020-21**

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
II	**Works under compliance of existing law.**							
1	Providing Fire detection and protection system in IT, Stores and CHP (MVW)	416.00		416.00		26(1)(d) &(b)	The work is necessary as per CEA Regulations, 2010 under compliance of existing law for security and safety of plant. The work includes providing automatic fire detection cum Medium velocity water (MVW) spray system for stacker-reclaimer(04 NOS.) of CHPand fire detection of IT building & central store at NTPC/TSTPS, Kaniha. The same was projected to be capitalised in Petition no 281/GT/2014. Hon'ble Commission, vide order dated 21.02.2017 in Review Petition no 47/RP/2016 in 2014-19 tariff, had stated that the matter would be considered at the time of true-up on the basis of CEA's recommendations. The work could not be completed in 2014-19 and have been projected in 2019-24. Hon'ble Commission may be pleased to allow the same.	
2	Supply, Retrofitting and Up-gradation of Passenger Lifts of Stage-1 (Unit-1 and Unit2) , TSTPS	130.00		130.00		25(2)(c)	There are two nos of OTIS make passenger lifts in stage 1, one each in unit 1 and unit 2. These lifts are approximately 25 years old and run on DC drive. The lifts are giving frequent problems because of very old technology. These need up gradation to new technology i,e VFD drive with microprocessor control to improve reliability. The job can be carried out by M/S OTIS Elevator Company India Ltd, who is OEM for the existing lift in the same set up. The work is essential for safety and security. Hon'ble Commission may be pleased to allow the same.	
	SUB Total II	**546.00**		**546.00**				
III	**Works towards safety and security.**							
1	Track MGR(7km)	2400.00		2400.00		25(2)(b) &(c)	Balance capitalisation , justification provided in Form 9 2019-20	
	SUB Total III	**2400.00**		**2400.00**				

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PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	**NTPC Limited**
Name of the Generating Station	**Talcher Super Thermal Power Station Stage-I**
COD	**7/1/1997**
For Financial Year	**2020-21**

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
IV	**Work due to Obsolescence of technology.**							
1	Design, Supply, Erection & Commissioning of ABT system	52		52		25(2) (c)	The existing ABT system is more than 10(Ten) years old & has completed its life. It is also observed that the system is hanging very frequently. The supports for server/ hardware are not available due to obscolenscenece. During this period many updates has been done to incorporate the changing requirements. In last few years it has been observed that each update in the legacy system affects various functionalities in the system. More and more patch work has made the system unstable which leads to increased maintenance requirement and disturbance in day to day operation. Increased load on the system has also contributed to this situation. The software technologies (dot net frame version-01, sql-2000) used in the system is obsolete now and it is difficult to get support on the same. Existing software of ABT is compatible with windows 32 system which has been obsolete in market. The architecture of the software is very old and hence not suitable for the dynamic changing (break even frequency & UI according to ECR) needs as per DSM (Demand settlement Mechanism). The system required to be replaced with new one for facilitating operation group towards smooth generation.In view of above Hon'ble Commission may be pleased to allow the same.	
	SUB Total IV	**52.00**	**0**	**52.00**				
	Total (A)= (I+II+III+IV)	**17,932.00**	**-**	**17,932.00**	**-**	**-**		

PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	**NTPC Limited**
Name of the Generating Station	**Talcher Super Thermal Power Station Stage-I**
COD	**7/1/1997**
For Financial Year	**2020-21**

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
B.	**Works beyond Original scope exluding add-cap due to Change in Law eligble for RoE at Wtd. Average rate of Interest**							
1	Construction of New ash dyke (Starter Dyke: Masunihata construction and its land)	1667		1667		26(1)(e)	The original ash dyke of TSTPS-I was designed for average PLF of 62.8% and much less ash quantity in coal. Over the period the norms have been raised to 85% of PLF/availability and coal quality of MCL mines has deteriorated . There is substantial increase in the ash generation that cannot be disposed with the existing ash ponds. The existing ash dyke is already nearing its full capacity. This would call for additional ash dyke for discharging ash. State administration has also given administrative approval for acquisition of 535 acres of land where Notification u/s 4(1) has already published for private land. The new ash dyke at Masunihata is planned to discharge ash slurry so as to sustain the generation of the station. Hon'ble Commission vide order dtd 30.07.2016 in Pet No 281/GT/2014 during 2014-19 had allowed this work and capitalisation towards land of Rs 24.58 Cr was allowed on projected basis, however the land could not be aquired during 2014-19 due to delay in Govt clerances. Due to delay in land aquisition the , the amount estimated has also increased from earlier 24.58 Cr to revised estimate of Rs 33 Cr projected now. Now the notification has already been issued by Govt for aquisition of land and ash dyke construction work is planned in 2019-24, Hon'ble Commission may please allow the same.	Rs 24.58 Cr allowed during 2014-19 order dated 30.07.2016 in Pet No 281/GT/2014.
2	Township Building work	178		178		26(1) with Reg 76	Installation of package AC in the public utility building would minimize the power consumption due to the quantum of standalone ACs owing to the large size of the structure. The work is required for promoting energy saving at sttaion , Hon'ble Commission may be plesaed to allow the same.	
	SUB Total II	**1845**	**0**	**1845**	**0**			
	Total (B)	**1,844.67**	**-**	**1,844.67**	**-**			
Total Add. Cap. Claimed (A+B)		**19,777**	**-**	**19,777**	**-**			

(Petitioner)

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PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	NTPC Limited
Name of the Generating Station	Talcher Super Thermal Power Station Stage-I
COD	7/1/1997
For Financial Year	2021-22

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
A.	**Works under Original scope, Change in Law etc. eligble for RoE at Normal Rate**							
I	**Ash dyke raising &Strengthening works.**							
2	Ash dyke works of Lagoon 2 (Including Raising)	6300		6300		25(1)(c)	Balance capitalisation , justification provided in Form 9 2019-20	Rs 33.52 Cr allowed during 2014-19 for ash dyke raising works of Lagoon-2 in order dated 30.07.2016 in Pet No 281/GT/2014.
	SUB Total I	**6300**		**6300**				
II	**Works towards safety and security.**							
1	Track MGR (7km)	800		800		25(2)(b) &(c)	Balance capitalisation , justification provided in Form 9 2019-20	
	SUB Total II	**800**		**800**				
III	**Work due to Obsolescence of technology.**							
1	Replacement of feed water chemical treatment from All volatile (oxidising) mode to Oxygeneted Treatment in St-1	135		135		25(2)(c)	The TSTPS stage-I units are Tower type once through boilers. The feed water cycle chemistry is being maintained in All volatile (Oxidising) mode with 100% CPU in service. In oxygenated treatment , Ferric oxide Hydrate (FeOOH) or Hematite (Fe2O3) forms over the porous magnetite layer is more stable in comparison that in AVT(O), which will minimize ' CRUD' in steam water cycle. Also in AVT(O) regime, CPU is operated at high pH (9.2-9.6) , thereby, chances of chloride slippage are high which may leads to Sulphide stress cracking in austenitic steel region of boiler. In view of better reliability and efficient operation of boiler due to new process , Hon'ble Commission may be pleased to allow the same.	
	SUB Total III	**135**	**0**	**135**				
Total Add. Cap. Claimed		**7,235.00**		**7,235.00**	-			

(Petitioner)

PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	NTPC Limited
Name of the Generating Station	Talcher Super Thermal Power Station Stage-I
COD	7/1/1997
For Financial Year	2022-23

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
A.	**Works under Original scope, Change in Law etc, eligble for RoE at Normal Rate**							
I	**Ash dyke raising &Strengthening works.**							
1	Ash mound L1 & L2	1000.00		1000.00		25(1) (c)&(g)	These are Original scope works related to ash dyke construction and ash handling. Additional ash mound is planned in existing ash dyke area of stage-I Lagoon-I &II based on expert advice from NIT rourkela. This ash mound will create additional space for discharging ash and also utilise ash in constructing the same. The construction of ash mound, is planned based on expert advice to help cater to ash handling and evacuation problems that TSTPS-I is facing. Hon'ble Commission may be pleased to allow the same.	
	SUB Total I	**1000**		**1000**				
II	**Works towards safety and security.**							
1	Track MGR (7km)	1000		1000		25(2)(b) &(c)	Balance capitalisation , justification provided in Form 9 2019-20	
	SUB Total III	**1000**		**1000**				
III	**Work due to Obsolescence of technology.**							
1	Replacement of Stage-I Stacker Reclaimer 1/2 DC drive to Variable frequency Drive (VFD).	600		600		25(2)(c)	Stacker cum Reclaimer 1and 2 of CHP are having DC drives for slew and travel with DC controllers of Kirloskar make. The OES of Stacker cum Reclaimers is M/S ELECON.M/s Kirloskar is unable to supply spares for controllers as these are obsolete. Hence reliability of the equipments is going down. It is proposed to replace the DC drives with VFD drives , associated MCC, cables, Operators desk, wireless communication in place of CCRD etc to improve reliability. Original Equipment Supplier M/S ELECON will supply and retrofit the VFD drives. The VFD will save energy and help in reducing APC consumption. In view of above Hon'ble Commission may be pleased to allow the same.	
	SUB Total III	**600**		**600**				
B.	**Works beyond Original scope exluding add-cap due to Change in Law eligble for RoE at Wtd. Average rate of Interest**							
1	Construction of New ash dyke (Starter Dyke: Masunihata construction and its land)	1667		1667		26(1)(e)	Balance capitalisation , justification provided in Form 9 2020-21	Rs 24.58 Cr allowed during 2014-19 order dated 30.07.2016 in Pet No 281/GT/2014.
	SUB Total I	**1667**		**1667**				
Total Add. Cap. Claimed (A+B)		**4,266.67**		**4,266.67**				

(Petitioner)

PART-I
FORM- 9

Year wise Statement of Additional Capitalisation after COD

Name of the Petitioner	NTPC Limited
Name of the Generating Station	Talcher Super Thermal Power Station Stage-I
COD	7/1/1997
For Financial Year	2023-24

Amount in Rs Lakh

Sl. No.	Head of Work /Equipment		ACE Claimed (Actual / Projected)			Regulations under which claimed	Justification	Admitted Cost by the Commission, if any
		Accrual basis as per IGAAP	Un-discharged Liability included in col. 3	Cash basis	IDC included in col. 3			
1	2	3	4	5= (3-4)	6	7	8	9
A.	**Works under Original scope, Change in Law etc. eligble for RoE at Normal Rate**							
I	**Ash dyke raising &Strengthening works.**							
1	Ash mound L1 & L2	1000.00		**1000.00**		25(1) (c)&(g)	Balance capitalisation , justification provided in Form 9 2022-23	
	SUB Total I	**1000.00**						
Total Add. Cap. Claimed		1,000.00		**1,000.00**				

(Petitioner)

PART-I
FORM- 10

Name of the Petitioner	**NTPC Limited**
Name of the Generating Station	**Talcher Super Thermal Power Station Stage-I**
Date of Commercial Operation	**01-07-97**

Amount in Rs Lakh

Financial Year (Starting from COD)1	Actual					Admitted				
	2019-20	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**
1		3	4	5	6	7	8	9	10	11
Amount capitalised in Work/ Equipment										
Financing Details	**Add cap is proposed to be finance in Debt:Equity ratio of 70:30**									
Loan-1										
Loan-2										
Loan-3 and so on										
Total Loan2										
Equity Internal Resources										
Others (Pl. specify)										
Total										

Note:
1. Year 1 refers to Financial Year of COD and Year 2, Year 3 etc. are the subsequent financial years respectively.
2. Loan details for meeting the additional capitalisation requirement should be given as per FORM-7 or 8 whichever is relevant.

(Petitioner)

PART-I
FORM- 12

Statement of Depreciation

Name of the Company :	NTPC Limited
Name of the Power Station :	Talcher Super Thermal Power Station Stage-I

(Amount in Rs Lakh)

S. No.	Particulars	Existing 2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7	8
1	Opening Capital Cost	265270.60	276,244.18	282,856.18	302,633.18	309,868.18	314,135.18
2	Closing Capital Cost	276244.18	282,856.18	302,633.18	309,868.18	314,135.18	315,135.18
3	Average Capital Cost	270757.39	279,550.18	292,744.68	306,250.68	312,001.68	314,635.18
1a*	Cost of IT Equipments & Software included in (1) above		-	-	-	-	-
2a*	Cost of IT Equipments & Software included in (2) above		-	-	-	-	-
3a*	Average Cost of IT Equipments & Software		-	-	-	-	-
4	Freehold land	2,831.54	2,831.54	2,831.54	2,831.54	2,831.54	2,831.54
5	Rate of depreciation	5.160					
6	Depreciable value	241,133.27	249,046.78	260,921.83	273,077.23	278,253.13	280,623.28
7.	Balance useful life at the beginning of the period	3.99	2.99	1.99	0.99	-	-
8	Remaining depreciable value	38,714.49	36,925.12	36,450.63	30,289.13	5,175.90	2,370.15
9	Depreciation (for the period)	0.00	12,349.54	18,316.90	30,289.13	5,175.90	2,370.15
10	Depreciation (annualised)	9,702.88	**12,349.54**	**18,316.90**	**30,289.13**	**5,175.90**	**2,370.15**
11	Cumulative depreciation at the end of the period		224,471.20	242,788.10	273,077.23	278,253.13	280,623.28
12	Less: Cumulative depreciation adjustment on account of un-discharged liabilities deducted as on 01.04.2009	0.00	-	-	-	-	-
13	Add: Cumulative depreciation adjustment on account of liability Discharge	0.00	-	-	-	-	-
14	Less: Cumulative depreciation adjustment on account of de-capitalisation	-428.31	-	-	-	-	-
15	Net Cumulative depreciation at the end of the period after adjustments	212,121.66	224,471.20	242,788.10	273,077.23	278,253.13	280,623.28

* Shall be provided at true-up

(Petitioner)

Details of unrecovered depreciation

Figures (Rs Lakh

		2002-03	2010-11	2011-12	2012-13		
1	Cummulative Availability achieved in year (%)		84.77	80.83	81.93		
2	Depreciation in annual fixed cost (Rs Lakh)		6253.49	6302.73	6461.33		
3	Unrecovered depreciation due to disincentive.(Rs Lakh)	**21.00**	**16.92**	**309.20**	**233.37**		
	TOTAL		**580.49**				

Petitioner

PART-I
FORM-13

Name of the Company: National Thermal Power Corporation Ltd
Name of the Power Station: Talcher-I

(Amount in lacs)

Sl. no.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
6	**SBI IX D9 Repayment in 9 yearly Installments from 31.03.2021**					
	Gross loan - Opening	4000.00	4000.00	4000.00	4000.00	4000.00
	Cumulative repayments of Loans upto previous year	0.00	0.00	444.44	888.89	1333.33
	Net loan - Opening	4000.00	4000.00	3555.56	3111.11	2666.67
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE	0.00	0.00	0.00	0.00	0.00
	Total	4000.00	4000.00	3555.56	3111.11	2666.67
	Less: Repayment (s) of Loans during the year	0.00	444.44	444.44	444.44	444.44
	Net loan - Closing	4000.00	3555.56	3111.11	2666.67	2222.22
	Average Net Loan	4000.00	3777.78	3333.33	2888.89	2444.44
	Rate of Interest on Loan	8.2500%	8.2500%	8.2500%	8.2500%	8.2500%
	Interest on loan	330.00	311.67	275.00	238.33	201.67
7	**SBI VIII D1 Repayment in 9 yearly Installments from 31.01.2022**					
	Gross loan - Opening	4000.00	4000.00	4000.00	4000.00	4000.00
	Cumulative repayments of Loans upto previous year	0.00	0.00	0.00	444.44	888.89
	Net loan - Opening	4000.00	4000.00	4000.00	3555.56	3111.11
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE	0.00	0.00	0.00	0.00	0.00
	Total	4000.00	4000.00	4000.00	3555.56	3111.11
	Less: Repayment (s) of Loans during the year	0.00	0.00	444.44	444.44	444.44
	Net loan - Closing	4000.00	4000.00	3555.56	3111.11	2666.67
	Average Net Loan	4000.00	4000.00	3777.78	3333.33	2888.89
	Rate of Interest on Loan	8.2500%	8.2500%	8.2500%	8.2500%	8.2500%
	Interest on loan	330.00	330.00	311.67	275.00	238.33
8	**SBI VIII D18 Repayment in 9 yearly Installments from 31.01.2022**					
	Gross loan - Opening	2100.00	2100.00	2100.00	2100.00	2100.00
	Cumulative repayments of Loans upto previous year	0.00	0.00	0.00	233.33	466.67
	Net loan - Opening	2100.00	2100.00	2100.00	1866.67	1633.33
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE	0.00	0.00	0.00	0.00	0.00
	Total	2100.00	2100.00	2100.00	1866.67	1633.33
	Less: Repayment (s) of Loans during the year	0.00	0.00	233.33	233.33	233.33
	Net loan - Closing	2100.00	2100.00	1866.67	1633.33	1400.00
	Average Net Loan	2100.00	2100.00	1983.33	1750.00	1516.67
	Rate of Interest on Loan	8.2500%	8.2500%	8.2500%	8.2500%	8.2500%
	Interest on loan	173.25	173.25	163.63	144.38	125.13
9	**HDFC IV D4 Repayment in 9 yearly Installments from 17.04.2021**					
	Gross loan - Opening	9000.00	9000.00	9000.00	9000.00	9000.00
	Cumulative repayments of Loans upto previous year	0.00	0.00	0.00	1000.00	2000.00
	Net loan - Opening	9000.00	9000.00	9000.00	8000.00	7000.00
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE	0.00	0.00	0.00	0.00	0.00
	Total	9000.00	9000.00	9000.00	8000.00	7000.00
	Less: Repayment (s) of Loans during the year	0.00	0.00	1000.00	1000.00	1000.00
	Net loan - Closing	9000.00	9000.00	8000.00	7000.00	6000.00
	Average Net Loan	9000.00	9000.00	8500.00	7500.00	6500.00
	Rate of Interest on Loan	8.4500%	8.4500%	8.4500%	8.4500%	8.4500%
	Interest on loan	760.50	760.50	718.25	633.75	549.25
10	**KFW ESP D1 Repayment in 16 Semi-Annual Installment from 15.09.2017**					
	Gross loan - Opening	503.86	503.86	503.86	503.86	503.86
	Cumulative repayments of Loans upto previous year	125.96	188.95	251.93	314.91	377.89
	Net loan - Opening	377.89	314.91	251.93	188.95	125.96
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE					
	Total	377.89	314.91	251.93	188.95	125.96
	Less: Repayment (s) of Loans during the year	62.98	62.98	62.98	62.98	62.98
	Net loan - Closing	314.91	251.93	188.95	125.96	62.98
	Average Net Loan	346.40	283.42	220.44	157.45	94.47
	Rate of Interest on Loan	3.1900%	3.1900%	3.1900%	3.1900%	3.1900%
	Interest on loan	11.05	9.04	7.03	5.02	3.01

PART-I
FORM-13

Name of the Company: National Thermal Power Corporation Ltd
Name of the Power Station: Talcher-I

(Amount in lacs)

Sl. no.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
1	**SBI-VII-T1D7**					
	Gross loan - Opening	1000.00	1000.00	1000.00	1000.00	1000.00
	Cumulative repayments of Loans upto previous year	500.00	625.00	750.00	875.00	1000.00
	Net loan - Opening	500.00	375.00	250.00	125.00	0.00
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE					
	Total	500.00	375.00	250.00	125.00	0.00
	Less: Repayment (s) of Loans during the year	125.00	125.00	125.00	125.00	0.00
	Net loan - Closing	375.00	250.00	125.00	0.00	0.00
	Average Net Loan	437.50	312.50	187.50	62.50	0.00
	Rate of Interest on Loan	8.2575%	8.2575%	8.2575%	8.2575%	8.2575%
	Interest on loan	36.13	25.80	15.48	5.16	0.00
2	**SBI-VII-T1D8**					
	Gross loan - Opening	1000.00	1000.00	1000.00	1000.00	1000.00
	Cumulative repayments of Loans upto previous year	500.00	625.00	750.00	875.00	1000.00
	Net loan - Opening	500.00	375.00	250.00	125.00	0.00
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE					
	Total	500.00	375.00	250.00	125.00	0.00
	Less: Repayment (s) of Loans during the year	125.00	125.00	125.00	125.00	0.00
	Net loan - Closing	375.00	250.00	125.00	0.00	0.00
	Average Net Loan	437.50	312.50	187.50	62.50	0.00
	Rate of Interest on Loan	8.2575%	8.2575%	8.2575%	8.2575%	8.2575%
	Interest on loan	36.13	25.80	15.48	5.16	0.00
3	**SBI-VII-T1D12**					
	Gross loan - Opening	1000.00	1000.00	1000.00	1000.00	1000.00
	Cumulative repayments of Loans upto previous year	500.00	625.00	750.00	875.00	1000.00
	Net loan - Opening	500.00	375.00	250.00	125.00	0.00
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE					
	Total	500.00	375.00	250.00	125.00	0.00
	Less: Repayment (s) of Loans during the year	125.00	125.00	125.00	125.00	0.00
	Net loan - Closing	375.00	250.00	125.00	0.00	0.00
	Average Net Loan	437.50	312.50	187.50	62.50	0.00
	Rate of Interest on Loan	8.2575%	8.2575%	8.2575%	8.2575%	8.2575%
	Interest on loan	36.13	25.80	15.48	5.16	0.00
4	**Bond series 54 Repayment Starting from 25.03.2023 3 installments**					
	Gross loan - Opening	1600.00	1600.00	1600.00	1600.00	1600.00
	Cumulative repayments of Loans upto previous year	0.00	0.00	0.00	0.00	320.00
	Net loan - Opening	1600.00	1600.00	1600.00	1600.00	1280.00
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE	0.00	0.00	0.00	0.00	0.00
	Total	1600.00	1600.00	1600.00	1600.00	1280.00
	Less: Repayment (s) of Loans during the year	0.00	0.00	0.00	320.00	640.00
	Net loan - Closing	1600.00	1600.00	1600.00	1280.00	640.00
	Average Net Loan	1600.00	1600.00	1600.00	1440.00	960.00
	Rate of Interest on Loan	8.5200%	8.5200%	8.5200%	8.5200%	8.5200%
	Interest on loan	136.32	136.32	136.32	122.69	81.79
5	**Bond series 57 Bullet Repayment on 15.12.2025**					
	Gross loan - Opening	1000.00	1000.00	1000.00	1000.00	1000.00
	Cumulative repayments of Loans upto previous year	0.00	0.00	0.00	0.00	0.00
	Net loan - Opening	1000.00	1000.00	1000.00	1000.00	1000.00
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE	0.00	0.00	0.00	0.00	0.00
	Total	1000.00	1000.00	1000.00	1000.00	1000.00
	Less: Repayment (s) of Loans during the year	0.00	0.00	0.00	0.00	0.00
	Net loan - Closing	1000.00	1000.00	1000.00	1000.00	1000.00
	Average Net Loan	1000.00	1000.00	1000.00	1000.00	1000.00
	Rate of Interest on Loan	8.2200%	8.2200%	8.2200%	8.2200%	8.2200%
	Interest on loan	82.20	82.20	82.20	82.20	82.20

PART-I
FORM-13

Name of the Company: National Thermal Power Corporation Ltd
Name of the Power Station: Talcher-I

(Amount in lacs)

Sl. no.	Particulars	2019-20	2020-21	2021-22	2022-23	2023-24
11	**KFW ESP D2 Repayment in 16 Semi-Annual Installment from 15.09.2017**					
	Gross loan - Opening	562.84	562.84	562.84	562.84	562.84
	Cumulative repayments of Loans upto previous year	140.71	211.07	281.42	351.78	422.13
	Net loan - Opening	422.13	351.78	281.42	211.07	140.71
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE					
	Total	422.13	351.78	281.42	211.07	140.71
	Less: Repayment (s) of Loans during the year	70.36	70.36	70.36	70.36	70.36
	Net loan - Closing	351.78	281.42	211.07	140.71	70.36
	Average Net Loan	386.95	316.60	246.24	175.89	105.53
	Rate of Interest on Loan	3.1900%	3.1900%	3.1900%	3.1900%	3.1900%
	Interest on loan	12.34	10.10	7.86	5.61	3.37
12	**KFW ESP D9 Repayment in 16 Semi-Annual Installment from 15.09.2017**					
	Gross loan - Opening	204.72	204.72	204.72	204.72	204.72
	Cumulative repayments of Loans upto previous year	51.18	76.77	102.36	127.95	153.54
	Net loan - Opening	153.54	127.95	102.36	76.77	51.18
	Increase/ Decrease due to FERV					
	Increase/ Decrease due to ACE	0.00	0.00	0.00	0.00	0.00
	Total	153.54	127.95	102.36	76.77	51.18
	Less: Repayment (s) of Loans during the year	25.59	25.59	25.59	25.59	25.59
	Net loan - Closing	127.95	102.36	76.77	51.18	25.59
	Average Net Loan	140.75	115.16	89.57	63.98	38.39
	Rate of Interest on Loan	3.1900%	3.1900%	3.1900%	3.1900%	3.1900%
	Interest on loan	4.49	3.67	2.86	2.04	1.22
	Total					
	Gross loan - Opening	25971.42	25971.42	25971.42	25971.42	25971.42
	Cumulative repayments of Loans upto previous year	1817.85	2351.78	3330.15	5986.30	8962.45
	Net loan - Opening	24153.56	23619.63	22641.26	19985.11	17008.96
	Increase/ Decrease due to FERV	0.00	0.00	0.00	0.00	0.00
	Increase/ Decrease due to ACE	0.00	0.00	0.00	0.00	0.00
	Total	24153.56	23619.63	22641.26	19985.11	17008.96
	Less: Repayment (s) of Loans during the year	533.93	978.37	2656.15	2976.15	2921.15
	Net loan - Closing	23619.63	22641.26	19985.11	17008.96	14087.82
	Average Net Loan	23886.60	23130.45	21313.19	18497.04	15548.39
	Rate of Interest on Loan	8.1574%	8.1891%	8.2168%	8.2419%	8.2708%
	Interest on loan	1948.53	1894.16	1751.25	1524.50	1285.97

Note:-
1) SBI VII Rate of interest includes upfront fees of 0.0075% (i.e. 0.08%*1.1236%/12years).

PART-I
FORM- 15

Details of Source wise Fuel for Computation of Energy Charges

Name of the Company :	NTPC Limited
Name of the Power Station :	Talcher Super Thermal Power Sation (Stage - I)

S. No.	Month	Unit	Oct-18			Nov-18			Dec-18		
			Domestic - MGR	Domestic - Rail	Imported	Domestic - MGR	Domestic - Rail	Imported	Domestic - MGR	Domestic - Rail	Imported
1	Quantity of Coal/Lignite supplied by Coal/Lignite Company*	(MMT)	200,993	1,004,277	1,192	334,424	944,173	69,395	367,550	1,000,705	41,229
2	Adjustment (+/-) in quantity supplied made by Coal/Lignite Company	(MMT)	-	-	-	-280	-531	-	-590	-1,077	-
3	Coal supplied by Coal/Lignite Company (1+2)	(MMT)	200,993	1,004,277	1,192	334,145	943,642	69,395	366,960	999,629	41,229
4	Normative Transit & Handling Losses (For coal/ Lignite based projects)	(MMT)	1,046	8,034	40	1,066	7,553	177	1,045	8,006	113
5	Net coal / Lignite Supplied (3-4)	(MMT)	199,947	996,243	1,152	333,079	936,089	69,218	365,915	991,623	41,116
6	Amount charged by the Coal /Lignite Company*	(Rs.)	-	1,879,380,273	-3,764,936	-	2,006,259,919	424,703,563	-	2,033,821,273	239,046,422
7	Adjustment (+/-) in amount charged made by Coal/Lignite Company	(Rs.)	-	-	-	-	-	-	-	-	-
8	Total amount Charged (6+7)	(Rs.)	-	1,879,380,273	-3,764,936	-	2,006,259,919	424,703,563	-	2,033,821,273	239,046,422
9	Transportation charges by rail/ship/road transport	(Rs.)	-	310,206,261	10,496,454	-	276,712,906	46,244,881	-	240,665,523	29,135,772
10	Adjustment (+/-) in amount charged made by Railways/Transport Company	(Rs.)	-	824,376	-	-	824,376	-	-	-26,716,243	-
11	Demurrage Charges, if any	(Rs.)	-	-	-	-	-	-	-	-	-
12	Cost of diesel in transporting coal through MGR system, if applicable	(Rs.)	-	23,679,750	225,808	-	26,981,277	-	-	19,160,782	772,872
13	Total Transportation Charges (9+-10-11+12)	(Rs.)	-	334,710,387	10,722,262	-	304,518,559	46,244,881	-	233,110,062	29,908,643
13A	Others (Stone picking, Loco drivers's salary,Sampling Charges etc)#			30,796,105	403,895		29,440,890	1,759,110		47,295,705	1,761,996
14	Total amount Charged for coal/lignite supplied including Transportation (8+13+13A)	(Rs.)	-	2,244,886,766	7,361,221	-	2,340,219,368	472,707,554	-	2,314,227,040	270,717,061
15	Landed cost of coal/ Lignite	Rs./MT	-	1,876.70	6,389.21	-	1,843.90	6,829.24	-	1,704.72	6,584.25
16	Blending Ratio (Domestic/Imported)			74.42			15.93			19.96	
17	Weighted average cost of coal	Rs./MT		1936.53			2138.43			1937.57	
18	GCV of Domestic Coal supplied as per bill of Coal Company	(kCal/Kg)		3285			3481			3675	
19	GCV of Imported Coal supplied as per bill Coal Company	(kCal/Kg)			5691			5669			5708
20	Weighted average GCV of coal/ Lignite as Billed	(kCal/Kg)		3316			3604			3748	
21	GCV of Domestic Coal as received at Station	(kCal/Kg)		2521			2662			2898	
22	GCV of Imported Coal as received at Station	(kCal/Kg)			4949			4882			4933
23	Weighted average GCV of coal as Received at station	(kCal/Kg)		2553			2793			2995	

* Includes opening stock.
#Additional data.

(Petitioner)

FORM 15 Annexure B

Details/Information to be provided to beneficiaries under Clause (6) of regulation 21 of CERC (Terms & Conditions of

Details/information to be submitted in respect of Fuel for computation of Energy Charges

Name of the Company:- NTPC LTD./ TALCHER STPP
Name of the power station:- Talcher Super Thermal Power Station
Month -OCT'18

Sl. No.	Particulars	Unit	STAGE 1			
			Domestic Coal			Imported Coal
			Supplied by MGR	Supplied by Rail	E-auction	
1	Quantity of Coal/Lignite supplied by Coal/Lignite Company *	(MT)	200993.15	1004277.48		1192.20
2	Adjustment (+/-) in quantity supplied made by Coal/Lignite Company	(MT)	0.00	0.00		0.00
3	Coal supplied by Coal/Lignite Company (1+2)	(MT)	200993.15	1004277.48		1192.20
4	Normative Transit & Handling Losses (For coal/Lignite based Projects)	(MT)	1046.15	8034.22		40.06
5	Net coal / Lignite Supplied (3-4)	(MT)	199947.01	996243.26		1152.13
6	Amount charged by the Coal /Lignite Company *	(Rs)	0.00	1879380273.34		-3764935.84
7	Adjustment (+/-) in amount charged made by Coal/Lignite Company	(Rs.)	0.00	0.00		0.00
8	Total amount Charged (6+7)	(Rs.)	0.00	1879380273.34		-3764935.84
9	Transportation charges by rail/ship/road transport	(Rs.)	0.00	310206261.31		10496453.60
10	Adjustment (+/-) in amount charged made by Railways/Transport Company	(Rs.)	0.00	824376.00		0.00
11	Demurrage Charges, if any	(Rs.)	0.00	0.00		0.00
12	Cost of diesel in transporting coal through MGR system, if applicable	(Rs.)	0.00	23679750.03		225808.17
13	Total Transportation Charges (9+/-10-11+12)	(Rs.)	0.00	334710387.34		10722261.77
13A	Others (Stone picking charges, Loco driver's salary, Sampling Charges etc.) #	(Rs)	0.00	30796105.13		403894.87
14	Total amount Charged for Coal/Lignite supplied including Transportation (8+13+13A)	(Rs)	0.00	2244886765.81		7361220.80
15	Landed cost of coal/ Lignite	(Rs./MT)	0.00	1876.70		6389.21
16	Blending Ratio (Domestic/ Imported)		74.42			
17	Weighted average cost of Coal	(Rs./MT)	1936.53			
18	GCV of Domestic Coal as per bill of Coal Company, EM basis	(kCal/Kg)	3285.00			
19	GCV of Imported Coal as per bill Coal Company, AD basis	(kCal/Kg)				5691
20	Weighted average GCV of coal/Lignite as Billed	(kCal/Kg)	3316			
21	GCV of Domestic Coal as received at Station, TM Basis	(kCal/Kg)	2521.00			
22	GCV of Imported Coal as received at Station, TM Basis	(kCal/Kg)				4949
23	Weighted average of Coal as received at Station	(kCal/Kg)	2553			
	# includes Opening Balance					

अजय साहू
AJAY SAHOO
उप महाप्रबंधक (वित्त) एस.एच.सी./ई भार-II
Dy. General Manager (Fin)SSC/ER-II
एनटीपीसी लिमिटेड/तालचेर कनिहा
NTPC Limited/Talcher Kaniha

For C.K. PRUSTY & ASSOCIATES
Chartered Accountants
Firm Reg. No. 323220E

CA C.K. PRUSTY, FCA
Partner
M. No.- 057318

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FORM 15 Annexure B

Details/Information to be provided to beneficiaries under Clause (6) of regulation 21 of CERC (Terms & Conditions of

Details/Information to be submitted in respect of Fuel for computation of Energy Charges

Name of the Company:- NTPC LTD./ TALCHER STPP
Name of the power station:- Talcher Super Thermal Power Station
Month -NOV'18

Sl. No.	Particulars	Unit	STAGE 1			
			Domestic Coal			Imported Coal
			Supplied by MGR	Supplied by Rail	E-auction	
1	Quantity of Coal/Lignite supplied by Coal/Lignite Company *	(MT)	334424.17	944173.39		69394.72
2	Adjustment (+/-) in quantity supplied made by Coal/Lignite Company	(MT)	-279.61	-531.27		0.00
3	Coal supplied by Coal/Lignite Company (1+2)	(MT)	334144.56	943642.12		69394.72
4	Normative Transit & Handling Losses (For coal/Lignite based Projects)	(MT)	1065.72	7553.39		176.51
5	Net coal / Lignite Supplied (3-4)	(MT)	333078.84	936088.73		69218.22
6	Amount charged by the Coal /Lignite Company *	(Rs.)	0.00	2006259919.11		424703562.72
7	Adjustment (+/-) in amount charged made by Coal/Lignite Company	(Rs.)	0.00	0.00		0.00
8	Total amount Charged (6+7)	(Rs.)	0.00	2006259919.11		424703562.72
9	Transportation charges by rail/ship/road transport	(Rs.)	0.00	276712905.86		46244881.16
10	Adjustment (+/-) in amount charged made by Railways/Transport Company	(Rs.)	0.00	824376.00		0.00
11	Demurrage Charges, if any	(Rs.)	0.00	0.00		0.00
12	Cost of diesel in transporting coal through MGR system, if applicable	(Rs.)	0.00	26981276.96		0.00
13	Total Transportation Charges (9+/-10-11+12)	(Rs.)	0.00	304518558.82		46244881.16
13A	Others (Stone picking charges, Loco driver's salary, Sampling Charges etc.) #	(Rs)	0.00	29440889.87		1759110.13
14	Total amount Charged for Coal/Lignite supplied including Transportation (8+13+13A)	(Rs)	0.00	2340219367.80		472707554.01
15	Landed cost of coal/ Lignite	(Rs./MT)	0.00	1843.90		6829.24
16	Blending Ratio (Domestic/ Imported)		15.93			
17	Weighted average cost of Coal	(Rs./MT)	2138.43			
18	GCV of Domestic Coal as per bill of Coal Company, EM basis	(kCal/Kg)	3481.00			
19	GCV of Imported Coal as per bill Coal Company, AD basis	(kCal/Kg)				5669
20	Weighted average GCV of coal/Lignite as Billed	(kCal/Kg)	3604			
21	GCV of Domestic Coal as received at Station, TM Basis	(kCal/Kg)	2662.00			
22	GCV of Imported Coal as received at Station, TM Basis	(kCal/Kg)				4882
23	Weighted average of Coal as received at Station	(kCal/Kg)	2793			
	# Includes Opening Balance					

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अजय साहू
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उप महाप्रबंधक (वित्त) एस.एस.एस./ई अर-II
Dy. General Manager (Fin)SSC/ER-II
एनटीपीसी लिमिटेड/तालचेर कनिहा
NTPC Limited / Talcher Kaniha

For C.K. PRUSTY & ASSOCIATES
Chartered Accountants
Firm Reg. No. 323220E

CA C.K. PRUSTY, FCA
Partner
M. No.- 057318

FORM 15 Annexure B

Details/Information to be provided to beneficiaries under Clause (6) of regulation 21 of CERC (Terms & Conditions of

Details/Information to be submitted in respect of Fuel for computation of Energy Charges

Name of the Company:- NTPC LTD./ TALCHER STPP
Name of the power station:- Talcher Super Thermal Power Station
Month -DEC'18

Sl. No.	Particulars	Unit	STAGE 1			
			Domestic Coal			Imported Coal
			Supplied by MGR	Supplied by Rail	E-auction	
1	Quantity of Coal/Lignite supplied by Coal/Lignite Company *	(MT)	367549.87	1000705.31		41229.32
2	Adjustment (+/-) in quantity supplied made by Coal/Lignite Company	(MT)	-589.72	-1076.67		0.00
3	Coal supplied by Coal/Lignite Company (1+2)	(MT)	366960.15	999628.64		41229.32
4	Normative Transit & Handling Losses (For coal/Lignite based Projects)	(MT)	1044.91	8005.64		113.49
5	Net coal / Lignite Supplied (3-4)	(MT)	365915.24	991623.00		41115.83
6	Amount charged by the Coal /Lignite Company *	(Rs.)	0.00	2033821272.87		239046421.63
7	Adjustment (+/-) in amount charged made by Coal/Lignite Company	(Rs.)	0.00	0.00		0.00
8	Total amount Charged (6+7)	(Rs.)	0.00	2033821272.87		239046421.63
9	Transportation charges by rail/ship/road transport	(Rs.)	0.00	240665523.22		29135771.60
10	Adjustment (+/-) in amount charged made by Railways/Transport Company	(Rs.)	0.00	-26716243.00		0.00
11	Demurrage Charges, if any	(Rs.)	0.00	0.00		0.00
12	Cost of diesel in transporting coal through MGR system, if applicable	(Rs.)	0.00	19160781.70		772871.87
13	Total Transportation Charges (9+/-10-11+12)	(Rs.)	0.00	233110061.92		29908643.46
13A	Others (Stone picking charges, Loco driver's salary, Sampling Charges etc.) #	(Rs)	0.00	47295704.71		1761996.08
14	Total amount Charged for Coal/Lignite supplied including Transportation (8+13+13A)	(Rs)	0.00	2314227039.51		270717061.17
15	Landed cost of coal/ Lignite	(Rs./MT)	0.00	1704.72		6584.25
16	Blending Ratio (Domestic/ Imported)		19.96			
17	Weighted average cost of Coal	(Rs./MT)	1937.57			
18	GCV of Domestic Coal as per bill of Coal Company, EM basis	(kCal/Kg)	3675.00			
19	GCV of Imported Coal as per bill Coal Company, AD basis	(kCal/Kg)				5708
20	Weighted average GCV of coal/Lignite as Billed.	(kCal/Kg)	3748			
21	GCV of Domestic Coal as received at Station, TM Basis	(kCal/Kg)	2898.00			
22	GCV of Imported Coal as received at Station, TM Basis	(kCal/Kg)				4933
23	Weighted average of Coal as received at Station	(kCal/Kg)	2995			

It includes Opening Balance

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Dy. General Manager (Fin)SSC/ER-II
एनटीपीसी लिमिटेड/तालचेर कनिहा
NTPC Limited / Talcher Kaniha

For C.K. PRUSTY & ASSOCIATES
Chartered Accountants
Firm Reg. No. 323220E

CA C.K. PRUSTY, FCA
Partner

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PART-I
FORM- 15A

Details of Secondary Fuel for Computation of Energy Charges

Name of the Company :	**NTPC Limited**
Name of the Power Station :	**Talcher Super Thermal Power Sation (Stage - I)**

Sl.No.	Month	Unit	Oct-18		Nov-18		Dec-18	
			LDO	HFO	LDO	HFO	LDO	HFO
1	Opening Stock of Oil		720	5108	683.459	4393.804	639.459	3703.804
2	Value of Opening Stock		36256809	213330496	34394798.8	183509858	32180516.5	154691594.5
3	Quantity of Oil supplied by Oil Company	KL	0					2939.32
4	Adjustment(+/-) in quantity supplied made by Oil Company	KL	0					
5	Oil supplied by Oil Company (3+4)	KL	0					2939.32
6	Normative Transit & Handling Losses	KL	0					0
7	Net Oil Supplied (5-6)	KL	0					2939.32
8	Amount charged by the Oil Company	(Rs)	0					127249594
9	Adjustment(+/-) in amount charged made by Oil Company	(Rs)	0					0
10	Total amount charged (8+9)	(Rs)	0					127249594
11	Transportation charges by rail / ship / road transport	(Rs)	0					
12	Adjustment (+/-) in amount charged made by Railways/Transport Company	(Rs)	0					
13	Demurrage Charges, if any	(Rs)	0					
14	Total Transportation Charges (11+/-12-13)	(Rs)	0					
15	Total amount Charged for fuel supplied including Transportation (10+14)	(Rs)	0					
16	Weighted average GCV of Oil as received	(kCal/L)	9906	9998	9906	9998	9906	9998
17	Quantity of Oil at station for the month (1+7)	KL	720	5108	683	4394	639	6643
18	Total amount charged for oil (2+15)	(Rs)	36256809	213330496	34394799	183509858	32180517	281941189
18	Landed cost of oil	(Rs/KL)	50324.60	41765.60	50324.52	41765.60	50324.60	42441.05

HFO is considered the Main Secondary Oil.

PETITIONER

15A

Details of Information to be submitted in respect of fuel for computation of energy charges

Name of the Company:- NTPC LTD./ TALCHER STPP
Name of the power station:- Talcher Super Thermal Power Project
Month - OCT'18

S NO	Month	Unit	STATION	
			LDO	HFO
1	Opening Stock of Oil	(KL)	720.46	5,107.80
2	Value of Opening Stock	(Rs.)	3,62,56,808.89	21,33,30,496.23
3	Quantity of Oil supplied by Oil Company	(KL)	0.00	0.00
4	Adjustment (+/-) in quantity made by Oil Company	(KL)		
5	Oil Supplied by Oil Company (3+4)	(KL)	0.00	0.00
6	Normative transit & Handling losses	(KL)		
7	Net Oil supplied (5-6)	(KL)	0.00	0.00
8	Amount charged by the Oil company	(Rs.)	0.0	0.0
9	Adjustment (+/-) in amount charged by Oil Company	(Rs.)		0.0
10	Total amount charged (8+9)	(Rs.)	0.0	0.0
11	Transportation charges by Rail/Ship/Road Transport	(Rs.)		
12	Adjustment (+/-) in amount charged by Railways/ transport company	(Rs.)	0.00	0.00
13	Demurrage charges , if any.	(Rs.)		
14	Total transportation charges 11+/-12-13)	(Rs.)	0.00	0.00
15	Total amount charged for Oil supplied including transportation (10+14)	(Rs.)	0.00	0.00
16	Weighted average GCV of OIL as Received	Kcal/KL	9,906.00	9,998.00
17	Quantity of Oil at station for the month (1+7)	(KL)	720.459	5107.804
18	Total amount charged for oil (2+15)	(Rs.)	36256808.89	213330496.23
19	Landed Cost of Oil (18/17)	Rs/Kl	50324.60	41765.60
20	Quantity of Oil consumed	(KL)	37.00	714.00
21	Value of Oil consumed (19*20)	(Rs.)	1862010.09	29820638.05
22	Closing Stock of Oil (17-20)	(KL)	683.459	4393.804
23	Value Of Closing Stock (18-21)	(Rs.)	34394798.799	183509858.18

Details of information to be submitted in respect of fuel for computation of energy charges

Station : TALCHER SUPER THERMAL POWER PROJECT
Month - OCT'18

			STAGE 1	
sl no	Particulars	Unit	LDO	HFO
1	Landed Cost of Oil at sl.no-19	Rs/Kl	50324.60	41765.60
2	Usage quantity for the month	Kl	13	307
3	Weighted average rate	Rs/Kl	42113.309	
4	Weighted average GCV of OIL on usage basis	(kcal/ltr)	9994	

नागप्रदीप अवधानम्
NAGAPRADEEPAVADHANAM
प्रबंधक (वित्त एवं लेखा) Manager (F&A)
एनटीपीसी लिमिटेड/तालचेर कनिहा
NTPC Limited / Talcher Kaniha

अजय साहु
AJAY SAHOO
उप महाप्रबंधक (वित्त) एस.एस.सी./ई भार-II
Dy. General Manager (Fin)SSC/ER-II
एनटीपीसी लिमिटेड/तालचेर कनिहा
NTPC Limited / Talcher Kaniha

For C.K. PRUSTY & ASSOCIATES
Chartered Accountants
Firm Reg. No. 323220E

CA C.K. PRUSTY, FCA
Partner
M. No.- 057318

Details of Information to be submitted in respect of fuel for computation of energy charges

Name of the Company:- NTPC LTD./ TALCHER STPP
Name of the power station:- Talcher Super Thermal Power Project
Month - Nov'18

S NO	Month	Unit	STATION	
			LDO	HFO
1	Opening Stock of Oil	(KL)	683.46	4,393.80
2	Value of Opening Stock	(Rs.)	3,43,94,798.80	18,35,09,858.18
3	Quantity of Oil supplied by Oil Company	(KL)	0.00	0.00
4	Adjustment (+/-) in quantity made by Oil Company	(KL)		
5	Oil Supplied by Oil Company (3+4)	(KL)	0.00	0.00
6	Normative transit & Handling losses	(KL)		
7	Net Oil supplied (5-6)	(KL)	0.00	0.00
8	Amount charged by the Oil company	(Rs.)	0.00	0.0
9	Adjustment (+/-) in amount charged by Oil Company	(Rs.)		0.0
10	Total amount charged (8+9)	(Rs.)	0.00	0.0
11	Transportation charges by Rail/Ship/Road Transport	(Rs.)		
12	Adjustment (+/-) in amount charged by Railways/ transport company	(Rs.)	0.00	0.00
13	Demurrage charges , if any.	(Rs.)		
14	Total transportation charges 11+/-12-13)	(Rs.)	0.00	0.00
15	Total amount charged for Oil supplied including transportation (10+14)	(Rs.)	0.00	0.00
16	Weighted average GCV of OIL as Received	Kcal/KL	9,906.00	9,998.00
17	Quantity of Oil at station for the month (1+7)	(KL)	683.46	4393.80
18	Total amount charged for oil (2+15)	(Rs.)	34394798.80	183509858.18
19	Landed Cost of Oil (18/17)	Rs/Kl	50324.60	41765.60
20	Quantity of Oil consumed	(KL)	44.00	690.00
21	Value of Oil consumed (19*20)	(Rs.)	2214282.27	28818263.66
22	Closing Stock of Oil (17-20)	(KL)	639.459	3703.80
23	Value Of Closing Stock (18-21)	(Rs.)	32180516.527	154691594.52

Details of information to be submitted in respect of fuel for computation of energy charges

Station : TALCHER SUPER THERMAL POWER PROJECT
Month - Nov'18

			STAGE 1	
sl no	Particulars	Unit	LDO	HFO
1	Landed Cost of Oil at sl.no-19	Rs/Kl	50324.60	41765.60
2	Usage quantity for the month	Kl	36	394
3	Weighted average rate	Rs/Kl	42482.167	
4	Weighted average GCV of OIL on usage basis	(kcal/ltr)	9990.3	

नागप्रदीप अवधानम्
NAGAPRADEEP AVADHANAM
Manager (F&A)
एनटीपीसी लिमिटेड/तालचेर कनिहा
NTPC Limited / Talcher Kaniha

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Dy. General Manager (Fin)SSC/ER-II
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NTPC Limited / Talcher Kaniha

For C.K. PRUSTY & ASSOCIATES
Chartered Accountants
Firm Reg. No. 323220E

CA C.K. PRUSTY, FCA
Partner
M. No.- 057318

Details of Information to be submitted in respect of fuel for computation of energy charges

Name of the Company:- NTPC LTD./ TALCHER STPP
Name of the power station:- Talcher Super Thermal Power Project
Month - DEC'18

S NO	Month	Unit	STATION	
			LDO	HFO
1	Opening Stock of Oil	(KL)	639.46	3,703.80
2	Value of Opening Stock	(Rs.)	3,21,80,516.53	15,46,91,594.52
3	Quantity of Oil supplied by Oil Company	(KL)	0.00	0.00
4	Adjustment (+/-) in quantity made by Oil Company	(KL)		
5	Oil Supplied by Oil Company (3+4)	(KL)	0.00	2939.32
6	Normative transit & Handling losses	(KL)		
7	Net Oil supplied (5-6)	(KL)	0.00	2939.32
8	Amount charged by the Oil company	(Rs.)	0.00	127249594.0
9	Adjustment (+/-) in amount charged by Oil Company	(Rs.)		0.0
10	Total amount charged (8+9)	(Rs.)	0.00	127249594.0
11	Transportation charges by Rail/Ship/Road Transport	(Rs.)		
12	Adjustment (+/-) in amount charged by Railways/ transport company	(Rs.)	0.00	0.00
13	Demurrage charges , if any.	(Rs.)		
14	Total transportation charges 11+/-12-13)	(Rs.)	0.00	0.00
15	Total amount charged for Oil supplied including transportation (10+14)	(Rs.)	0.00	127249594.00
16	Weighted average GCV of OIL as Received	Kcal/KL	9,906.00	9,998.00
17	Quantity of Oil at station for the month (1+7)	(KL)	639.46	6643.12
18	Total amount charged for oil (2+15)	(Rs.)	32180516.53	281941188.52
19	Landed Cost of Oil (18/17)	Rs/Kl	50324.60	42441.05
20	Quantity of Oil consumed	(KL)	10.00	304.00
21	Value of Oil consumed (19*20)	(Rs.)	503245.97	12902080.60
22	Closing Stock of Oil (17-20)	(KL)	629.459	6339.12
23	Value Of Closing Stock (18-21)	(Rs.)	31677270.557	269039107.92

Details of information to be submitted in respect of fuel for computation of energy charges

Station : TALCHER SUPER THERMAL POWER PROJECT
Month - DEC'18

STAGE 2

sl no	Particulars	Unit	LDO	HFO
1	Landed Cost of Oil at sl.no-19	Rs/Kl	50324.60	42441.05
2	Usage quantity for the month	Kl	0	152
3	Weighted average rate	Rs/Kl	42441.055	
4	Weighted average GCV of OIL on usage basis	(kcal/ltr)	9998	

नागप्रदीप अग्रवाल
NAGAPRADEEP AGRAWAL
Manager (F&A)
एनटीपीसी लिमिटेड / तालचेर कनिहा
NTPC Limited / Talcher Kaniha

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For C.K. PRUSTY & ASSOCIATES
Chartered Accountants
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CA C.K. PRUSTY, FCA
Partner
M. No.- 057318

Computation of Energy Charges

Form-15B
ADDITIONAL FORM

Name of the Company	**NTPC Limited**
Name of the Power Station	**Talcher Super Thermal Power Station Stage-I**

Computation of Energy Charges

1	Rate of Energy Charge from Sec. Fuel Oil/ Alternate Fuel (p/kwh) $(REC)_s$	$= (Q_s)_n \times P_s$	2.102
2	Heat Contribution from SFO / Alternate Fuel (H_s)	$= (Qs)_n \times (GCV)_s$	4.999
3	Heat Contribution from coal $(H_p)_s$	$= GHR - H_s$	2385.00
4	Specific Primary Fuel Consumption $(Qp)_n$	$= H_p / (GCV)_p$	0.881
5	Rate of Energy charge from Primary Fuel (p/kwh) $(REC)_p$		171.328
6	Rate of Energy charge ex-bus (p/kWh) (REC)	$= ((REC)_s + (REC)_p / (1-(AUX))$	186.584

		2019-20	2020-21	2021-22	2022-23	2023-24
No of Days in the year	Days	366	365	365	365	366
Sp. Oil consumption	ml/kwh	0.5	0.5	0.5	0.5	0.5
Auxiliary consumption	%	7.05	7.05	7.05	7.05	7.05
Heat Rate	Kcal/Kwh	2,390.00	2,390.00	2,390.00	2,390.00	2390
Computation of Variable Charges						
Variable Charge (Coal)	p/kwh	184.323	184.323	184.323	184.323	184.323
Variable Charge (Oil)	p/kwh	2.262	2.262	2.262	2.262	2.262
Total	p/kwh	186.584	186.584	186.584	186.584	186.584
Price of fuel from Form-15/15A						
Coal Cost	(Rs./MT)	1944.43	1944.43	1944.43	1944.43	1944.43
Oil Cost	(Rs./KL)	42043.54	42043.54	42043.54	42043.54	42043.54
Computation of Fuel Expenses for Calculation of IWC:						
ESO in a year	(MUs)	6940.02	6921.06	6921.06	6921.06	6940.019
ESO for 40 days	(MUs)	758.472	758.472	758.47	758.47	758.472
Cost of coal for 45 Days	(Rs. Lakh)	13980.37	13980.37	13980.37	13980.37	13980.37
Cost of oil for 2 months	(Rs. Lakh)	261.59	260.88	260.88	260.88	261.59
Energy Expenses for 45 days	(Rs. Lakh)	15920.90	15920.90	15920.90	15920.90	15920.90

Coal		**3rd month**	**2nd month**	**1st month**	**Wtd. Avg.**
Wtd. Avg. Price of Coal	Rs./MT	1936.53	2138.43	1937.57	**1944.43**
Wtd. Avg. GCV of Coal as received	kCal/Kg	2553	2793	2995	**2791.77**
Wtd. Avg. GCV of Coal as received after adjustement of 85 kcal/kg					**2706.77**
Sec. Oil					
Wtd. Avg. Price of Secondary Fuel	Rs/KL	41765.60	41765.60	42441.05	**42043.54**
Wtd. Avg. GCV of Secondary Fuel	kCal/L	9998.00	9998.00	9998.00	**9998.00**

PETITIONER

PART 1
FORM- H

Statement of Additional Capitalisation during five year before the end of useful life of the Project

Name of the Company :	NTPC Limited
Name of the Power Station :	Talcher Super Thermal Power Station Stage-I
COD	01-07-97

(Amount in Rs. Lakh)

S. No.	Year	Work / Equipment added during last five years of useful life of each Unit/Station	ACE Claimed (Actual / Projected)				Regulations under which claimed	Justification	Impact on life extension
			Accrual basis	Un-discharged Liability included in col. 4	Cash basis	IDC included in col. 4			
1	2	3	4	5	(6 = 4 - 5)	7	8	9	10
Not applicable									

Note:

1. Cost Benefit analysis for capital additions done should be submitted along with petition for approval of such schemes

2. Justification for additional capital expenditure claim for each asset should be relevant to regulations under which claim has been made and the necessity of capitalization of the asset.

(Petitioner)

PART 1
FORM- L

Name of the Petitioner: NTPC Ltd
Name of the Generating Station: Talcher Super Thermal Power Station Stage-I

Statement of Capital cost
(To be given for relevant dates and year wise)

(Amount in Rs. Lakh)

S. No.	Particulars	As on relevant date		
		Accrual Basis	Un-discharged Liabilities	Cash Basis
A	a) Opening Gross Block Amount as per books	291156.24	3451.77	287704.47
	b) Amount of IDC in A(a) above	841.32		
	c) Amount of FC in A(a) above	0.00		
	d) Amount of FERV in A(a) above	-206.83		
	e) Amount of Hedging Cost in A(a) above	0.00		
	f) Amount of IEDC in A(a) above	0.00		
B	a) Addition in Gross Block Amount during the period (Direct purchases)			
	b) Amount of IDC in B(a) above			
	c) Amount of FC in B(a) above			
	d) Amount of FERV in B(a) above			
	e) Amount of Hedging Cost in B(a) above			
	f) Amount of IEDC in B(a) above			
C	a) Addition in Gross Block Amount during the period (Transferred from CWIP)			
	b) Amount of IDC in C(a) above			
	c) Amount of FC in C(a) above			
	d) Amount of FERV in C(a) above			
	e) Amount of Hedging Cost in C(a) above			
	f) Amount of IEDC in C(a) above			
D	a) Deletion in Gross Block Amount during the period			
	b) Amount of IDC in D(a) above			
	c) Amount of FC in D(a) above			
	d) Amount of FERV in D(a) above			
	e) Amount of Hedging Cost in D(a) above			
	f) Amount of IEDC in D(a) above			
E	a) Closing Gross Block Amount as per books			
	b) Amount of IDC in E(a) above			
	c) Amount of FC in E(a) above			
	d) Amount of FERV in E(a) above			
	e) Amount of Hedging Cost in E(a) above			
	f) Amount of IEDC in E(a) above			

(Petitioner)

PART 1
FORM- M

Name of the Petitioner: NTPC Ltd
Name of the Generating Station: Talcher Super Thermal Power Station Stage-I

Statement of Capital Woks in Progress

(To be given for relevant dates and year wise)

(Amount in Rs. Lakh)

S. No.	Particulars	As on relevant date		
		Accrual Basis	Un-discharged Liabilities	Cash Basis
A	a) Opening CWIP as per books	1019.01	270.93	748.08
	b) Amount of IDC in A(a) above	137.28		
	c) Amount of FC in A(a) above	0.00		
	d) Amount of FERV in A(a) above	0.00		
	e) Amount of Hedging Cost in A(a) above	0.00		
	f) Amount of IEDC in A(a) above	0.00		
B	a) Addition in CWIP during the period			
	b) Amount of IDC in B(a) above			
	c) Amount of FC in B(a) above			
	d) Amount of FERV in B(a) above			
	e) Amount of Hedging Cost in B(a) above			
	f) Amount of IEDC in B(a) above			
C	a) Transferred to Gross Block Amount during the period			
	b) Amount of IDC in C(a) above			
	c) Amount of FC in C(a) above			
	d) Amount of FERV in C(a) above			
	e) Amount of Hedging Cost in C(a) above			
	f) Amount of IEDC in C(a) above			
D	a) Deletion in CWIP during the period			
	b) Amount of IDC in D(a) above			
	c) Amount of FC in D(a) above			
	d) Amount of FERV in D(a) above			
	e) Amount of Hedging Cost in D(a) above			
	f) Amount of IEDC in D(a) above			
E	a) Closing CWIP as per books			
	b) Amount of IDC in E(a) above			
	c) Amount of FC in E(a) above			
	d) Amount of FERV in E(a) above			
	e) Amount of Hedging Cost in E(a) above			
	f) Amount of IEDC in E(a) above			

(Petitioner)

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PART-I
FORM- N

Calculation of Interest on Normative Loan

Name of the Company :	**NTPC Limited**
Name of the Power Station :	**Talcher Super Thermal Power Station Stage-I**

(Amount in Rs Lakh)

S. No.	Particulars	Existing 2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7	8
1	Gross Normative loan – Opening	135,516.81	143,198.31	147,826.71	161,670.61	166,735.11	169,722.01
2	Cumulative repayment of Normative loan up to previous year	135,516.81	143,198.31	147,826.71	161,670.61	166,735.11	169,722.01
3	**Net Normative loan – Opening**	-	-	-	-	-	-
4	Add: Increase due to addition during the year / period	7834.91	4,628.40	13,843.90	5,064.50	2,986.90	700.00
5	Less: Decrease due to de-capitalisation during the year / period	-333.13	0.00	0.00	0.00	0.00	0.00
6	Less: Decrease due to reversal during the year / period						
7	Add: Increase due to discharges during the year / period	179.73	0.00	0.00	0.00	0.00	0.00
8	Less: Repayment of Loan	7681.50	4628.40	13843.90	5064.50	2986.90	700.00
9	**Net Normative loan - Closing**	-	-	-	-	-	-
10	**Average Normative loan**	-	-	-	-	-	-
11	Weighted average rate of interest	6.6760	8.1574	8.1891	8.2168	8.2419	8.2708
12	**Interest on Loan**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

(Petitioner)

PART I
FORM- O

Calculation of Interest on Working Capital

Name of the Company :	**NTPC Limited**
Name of the Power Station :	**Talcher Super Thermal Power Station Stage-I**

(Amount in Rs Lakh)

S. No.	Particulars	Existing 2018-19	2019-20	2020-21	2021-22	2022-23	2023-24
1	2	3	4	5	6	7	8
1	Cost of Coal/Lignite	10,722.59	13980.37	13980.37	13980.37	13980.37	13980.37
2	Cost of Main Secondary Fuel Oil	296.22	261.59	260.88	260.88	260.88	261.59
3	Fuel Cost						
4	Liquid Fuel Stock						
5	O & M Expenses	1,903.01	2175.60	2266.46	2361.43	2460.11	2562.48
6	Maintenance Spares	4,567.22	5221.45	5439.49	5667.44	5904.27	6149.96
7	Receivables	25,659.76	24426.97	25428.48	27166.46	23048.40	22852.85
8	Total Working Capital	43148.80	46065.99	47375.68	49436.58	45654.04	45807.26
9	Rate of Interest	13.5000	12.0500	12.0500	12.0500	12.0500	12.0500
10	**Interest on Working Capital**	**5825.09**	**5550.95**	**5708.77**	**5957.11**	**5501.31**	**5519.77**

Petitioner

Flow of Capital liabilities from 01.04.2019

Form-S
Fig in Rs

Sr. No.	Name of the Party	Name of the work	Year of creation of liability capitalised in Gross Block	Allowed/Disallowed/ Claimed	Undischarged liabilities relating to GB 31.03.2019
1	2	3	4	5	6
1	Spl LAO	R&R Liab (RAP) for acq. of Freehold Land St - I	2008-09	Allowed	30000000
28	Special Land Acquisition Officer,Ra	Vill. - BANTOL LA Case No.23/89. AS per System circular 104/2015 (Court cases)-13 Cour Case	2014-15	Claimed	1201086
35	Minimax GmbH & Co KG	INERT GAS FIRE EXTINGUISHER SYSTEM IN STAGE-I(MAIN EQUIPMENT).	2014-15	Allowed	1006335
36	Minimax GmbH & Co KG	CIVIL WORKS FOR INERT GAS FIRE EXTINGUISHERSYATEM STAGE-I	2014-15	Allowed	947232
37	Minimax GmbH & Co KG	Installation Services -inert gas fire ex	2014-15	Allowed	341074
52	YOKOGAWA INDIA LTD	R&M PACKAGE OF DDCMIS ST-I	2014-15	Not claimed	6270231
60	ABB India Ltd.	Mandatory Spares of PLC Package	2014-15	Not allowed	216000
92	BUDHRAJA MINING & CONSTRUCTION L	Construction of 6th raising of Lagoon-II of Stage-I ash dyke of TSTPS. (2X500MW).	2015-16	Allowed	75352
96	SIDHARTH CONSTRUCTION &	Buttressing of Lagoon-I, Stage-I ash dyke, Phase-I.	2015-16	Allowed	45983341
97	YOKOGAWA INDIA LTD	R&M PACKAGE OF DDCMIS ST-I (ERECTION & COMMISSIONING)	2015-16	Not claimed	765000
	1057697 SRI DURGA CONDEV PVT LTD	Construction of 7th raising of Lagoon-2, Stage-I Ash Dyke of TSTPS (2X500MW).	2016-17	Allowed	3269629
103	GODREJ & BOYCE MFG CO LTD	PROCUREMENT OF 400 NB MS ERW PIPE	2016-17	Allowed	410326
105	SASWAT KUMAR SAHOO	32CH.DIG.INPUT MODULE:ADV151-E,YOKOGAWA	2016-17	Not claimed	24870
108	1052687 BUDHRAJA MINING & CONSTRUCTION LTD	Construction of 6th raising of Lagoon-II of Stage-I ash dyke of TSTPS. (2X500MW).	2017-18	Allowed	25048
109	1057697 SRI DURGA CONDEV PVT LTD	Construction of 7th raising of Lagoon-2, Stage-I Ash Dyke of TSTPS (2X500MW).	2017-18	Allowed	843637
110	1037120 SIDHARTH CONSTRUCTION &	Buttressing of Lagoon-I, Stage-I ash dyke, Phase-I.	2017-18	Allowed	11803155
111	1056062 SAMAL BUILDERS PVT LTD	Buttressing of lagoon-1,Stage-I Ash Dyke, Phase-III(From RL 120.35 to RL 123.35) at TSTPS Kaniha	2017-18	Allowed	2063919
112	1052687 BUDHRAJA MINING & CONSTRUCTION LTD	Interim Strengthening as a part of buttressing of lag-2,St-I Ash Dyke of TSTPS)(Phase-I).	2017-18	Allowed	8752060
113	1056062 SAMAL BUILDERS PVT LTD	Buttressing of lagoon-1,Stage-I Ash Dyke ,Ph-II (From RL 114.35-120.35)(Phase-II).	2017-18	Allowed	6821480
114	1004972 THE INDURE PVT LTD	A H P UNIT NO 1	2017-18	Allowed	600000
115	1004972 THE INDURE PVT LTD	A H P UNIT NO 1	2017-18	Allowed	1084375
116	1004972 THE INDURE PVT LTD	A H P UNIT NO 1	2017-18	Allowed	435001
117	1004972 THE INDURE PVT LTD	A H P UNIT NO 1	2017-18	Allowed	102500
118	1056062 SAMAL BUILDERS PVT LTD	SEEPAGE WATER RECIRCULATION SYSTEM	2017-18	Allowed	1755404
119	1066679 OMM ENGINEERING	SEEPAGE WATER RECIRCULATION SYSTEM	2017-18	Allowed	222259

Flow of Capital liabilities from 01.04.2019

Form-S
Fig in Rs

Sr. No.	Name of the Party	Name of the work	Year of creation of liability capitalised in Gross Block	Allowed/Disallowed/ Claimed	Undischarged liabilities relating to GB 31.03.2019
1	2	3	4	5	6
121	1017466 DUBAS ENGINEERING PVT LTD	BATTERY CHARGERS	2017-18	Not claimed	993820
122	1017466 DUBAS ENGINEERING PVT LTD	BATTERY CHARGERS	2017-18	Not claimed	62472
125	1074554 Schweitzer Engineering	NUMERICAL FEEDER PROTECTION RELAY 1A	2017-18	Not claimed	22395
126	1074554 Schweitzer Engineering	NUMERICAL FEEDER PROTECTION RELAY 1A	2017-18	Not claimed	63991
127	1074554 Schweitzer Engineering	NUMERICAL FEEDER PROTECTION RELAY 1A	2017-18	Not claimed	63991
128	1074554 Schweitzer Engineering	NUMERICAL FEEDER PROTECTION RELAY 1A	2017-18	Not claimed	63991
129	1074554 Schweitzer Engineering	NUMERICAL FEEDER PROTECTION RELAY 1A	2017-18	Not claimed	63991
130	1074554 Schweitzer Engineering	NUMERICAL FEEDER PROTECTION RELAY 1A.	2017-18	Not claimed	63991
131	1074554 Schweitzer Engineering	NUMERICAL FEEDER PROTECTION RELAY 1A	2017-18	Not claimed	63991
132	1074554 Schweitzer Engineering	NUMERICAL FEEDER PROTECTION RELAY 1A	2017-18	Not claimed	63991
133	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
134	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
135	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
136	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
137	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
138	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
139	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
140	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
141	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
142	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
143	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
144	1074554 Schweitzer Engineering	NUMERICAL XFMR DIFFERENTIAL RELAY 1A	2017-18	Not claimed	120033
145	1003517 Mcnally Sayaji Engineering Limited	TKK48X114:ROTOR ASSY.	2017-18	Not claimed	195000
147	1026800 HAWA VALVES INDIA PVT LTD	GT VLV API:600 FLGD WC-6 CL-150 200MM	2017-18	Not claimed	26767
148	1006668 BHARAT HEAVY ELECTRICALS LTD	Supply of Renovation & Retrofitting of ESP Package for Talcher Super thermal Power Station, Stage-I (2 X 500 MW).	2018-19	Allowed	30331862
149	1006668 BHARAT HEAVY ELECTRICALS LTD	Erection contract for Renovation & Retrofitting of ESP Stage-I Package.	2018-19	Allowed	27313239
150	1006668 BHARAT HEAVY ELECTRICALS LTD	Supply of Renovation & Retrofitting of ESP Package for Talcher Super thermal Power Station, Stage-I (2 X 500 MW).	2018-19	Allowed	2749383

Flow of Capital liabilities from 01.04.2019

Form-S
Fig in Rs

Sr. No.	Name of the Party	Name of the work	Year of creation of liability capitalised in Gross Block	Allowed/Disallowed/ Claimed	Undischarged liabilities relating to GB 31.03.2019
1	2	3	4	5	6
151	1006668 BHARAT HEAVY ELECTRICALS LTD	Supply of Renovation & Retrofitting of ESP Package for Talcher Super thermal Power Station, Stage-I (2 X 500 MW).	2018-19	Allowed	30331862
152	1006668 BHARAT HEAVY ELECTRICALS LTD	Erection contract for Renovation & Retrofitting of ESP Stage-I Package.	2018-19	Allowed	27313239
153	1006668 BHARAT HEAVY ELECTRICALS LTD	Supply of Renovation & Retrofitting of ESP Package for Talcher Super thermal Power Station, Stage-I (2 X 500 MW).	2018-19	Allowed	2749383
154	1052687 BUDHRAJA MINING & CONSTRUCTION LTD	Construction of 7th raising Lagoon-I, Stage-I Ash dyke	2018-19	Allowed	2553264
155	1037120 SIDHARTH CONSTRUCTION &	Buttressing of Lagoon-I, Stage-I ash dyke, Phase-I.	2018-19	Allowed	23707177
156	1056062 SAMAL BUILDERS PVT LTD	Buttressing of lagoon-1,Stage-I Ash Dyke, Phase-III(From RL 120.35 to RL 123.35) at TSTPS Kaniha	2018-19	Allowed	13729644
157	1056062 SAMAL BUILDERS PVT LTD	Buttressing of lagoon-1,Stage-I Ash Dyke ,Ph-II (From RL 114.35-120.35)(Phase-II).	2018-19	Allowed	25364485
158	1048462 K N INTERNATIONAL LTD	Buttresing of lagoon-2, Stage-I Ash Dyke except Over flow lagoon(OFL) ,Ph-I(Upto RL 105.00).	2018-19	Allowed	13754314
159	1108829 GURU MAHARAJ CONSTRUCTION	Buttresing of lagoon-2, Stage-I ash dyke for over flow lagoon(OFL), Ph-II(Upto RL 105.00).	2018-19	Allowed	5782876
160	1006775 HI TECH SYSTEMS & SERVICES LTD	Supply (Main Equipment & Mandatory Spares), Erection & Commissioning of Boiler Acoustic Steam Leakage Detection (ASLD) System in Stage-1 & 2 (Units 1,2,3 & 4) of NTPC- Talcher Super Thermal Power Station.(Supply Portion)	2018-19	Not claimed	3174200
161	1006775 HI TECH SYSTEMS & SERVICES LTD	Supply (Main Equipment & Mandatory Spares), Erection & Commissioning of Boiler Acoustic Steam Leakage Detection (ASLD) System in Stage-1 & 2 (Units 1,2,3 & 4) of NTPC- Talcher Super Thermal Power Station. (Erection portion)	2018-19	Not claimed	199420
162	1043673 Flowserve India Controls Pvt Ltd	COMPLETE CARTRIDGE FOR BFP SNo 576-126/2016 (5Yrs)	2018-19	Not claimed	6992002
163	1052663 Bharat Heavy Electricals Ltd	400 KV CT,5 CORE,BHEL MAKE	2018-19	Not claimed	922588
		TOTAL			**345177038**
		Liability corresponding to works not allowed.			**216000**
		Liability corresponding to works not claimed.			**21537098**
		Liability corresponding to works Allowed/ claimed.			**323423940**
		Total			**345177038**

PART 1
FORM-T

Summary of issue involved in the petition

Name of the Company :		NTPC Limited	
Name of the Power Station :		Talcher Super Thermal Power Station Stage-I	
1	Petitioner:	NTPC Limited	
2	Subject	Tariff petition for 2019-24	
3	Prayer: i) Approve tariff of Talcher Super Thermal Power Station Stage-I for the tariff period 01.04.2019 to 31.03.2024. ii) Allow the recovery of filing fees as & when paid to the Hon'ble Commission and publication expenses from the beneficiaries. iii) Allow reimbursement of Ash Transportation Charges directly from the beneficiaries quarterly on net basis.		
4	Respondents		
	Name of Respondents		
	a. WBSEDCL		d. Jharkhand Bijlee Vitran Nigam Ltd
	b.North Bihar Power Distribution company Ltd		e. GRIDCO Ltd
	c. South Bihar Power Distribution company Ltd		& Others
5	Project Scope		
	Cost		
	Commissioning		
	Claim		
	AFC		
	Capital cost		
	Initial spare		
	NAPAF (Gen)		
	Any Specific		

Annexure- A

DESIGN REPORT

ON

STRENGTHENING & BUTTRESSING

and

PERIPHERAL DYKE RAISING

Of

LAGOON – 2, STAGE – I, NTPC KANHIA

FOR DISPOSAL OF ASH

Of

TALCHER SUPER THERMAL POWER PLANT, KANHIA, ODISHA

Submitted by

Dr. C R Patra
Professor
NIT Rourkela

Dr. Umesh Dayal
Professor (Retd.)
IIT Kanpur

(Consultants)

1.0 INTRODUCTION

Talcher Super Thermal Power Station, NTPC Limited, Kanhia, Orissa (TSTPS) awarded a consultancy project to Dr. C. R. Patra, Professor, Civil Engineering Department, National Institute of Technology Rourkela and Dr. Umesh Dayal, Professor (Retired), Indian Institute of Technology, Kanpur (consultants) for enhancing the ash storage capacity of the existing Ash Ponds of Lagoon -2 of Stage – I vide NTPC Purchase Order No.:5000000649-025-1026 dated 28-11-2015.

NTPC owns and operates Talcher Super Thermal Power Station located at Kahia, Orissa. The is a coal fired thermal power plant where flyash and bottom ash are mixed together at the plant and disposed off as combined ash in slurry form through pipe lines in the lagoons. The lagoons are constructed in two Stages; Stage - I and Stage - II. Stage - I and Stage - II ash dyke are located 6 and 12 kms, respectively from the power plant. Stage - I disposal site consists of two lagoons; Lagoon – 1 and Lagoon - 2. Lagoon - 1 was constructed earlier to lagoon - 2. Both the lagoons are separated by a divide bund. The Starter Dyke has been constructed with earth and subsequent raisings are constructed using pond ash and covered with earth materials. The Stage - I ash dyke is raised by upstream method of construction. A design report was submitted earlier to NTPC Kanhia regarding the buttressing of Lagoon 1. The buttressing of Lagoon 1 is presently being constructed. Earlier, consultants submitted a design scheme for strengthening of the Lagoon – 2 before any raising which was implemented by TSTPS. Presently, the construction is in progress for 7^{th} raising of lagoon - 2 dyke. It is not prudent to further load the dyke and also by u/s raising the capacity enhancement of lagoon 2 will not be beneficial. Present top RL of 7^{th}raising is at El. 120 m. The project is located in Seismic Zone III. Hence, it is proposed to strengthen the existing dykes by D/S buttressing prior to further raising.

The total area of the Stage I Ash Dyke is about 750 acres and the total area of Stage - II dyke is about 850 acres. Separate pipe lines are laid for Stage I and Stage II dykes for conveying slurry from different power plant units. As mentioned earlier, Lagoon 2 of Stage I ash dykes are full to its capacity and to further enhance the capacity of the lagoon, it needs strengthening buttressing and D/S raising. NTPC requested consultants to

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evaluate the suitability and suggest the required measures should be adopted for enhancing the existing capacity for disposing ash slurry in to lagoon – 2 of Stage – I. Dr. Patra visited the site in the month of August 2015 and observed serious settlement of the embankment slope and toe of 1st and 2nd raising and recommended that the lagoon in the existing condition is not suitable for further discharging of ash slurry into the lagoon. This lagoon was already raised up to 4th raisings. The consultants explored various feasible, safe and economical schemes for buttressing of the existing dyke and held discussions with engineers and management of TSTPS for suitability of the various schemes. Based on site evaluation and meetings with the consultants and the managements of TSTPS it was concluded that the Down Stream (D/S) raising method would be the safest method for enhancing the capacity of existing lagoon.

This report provides the design scheme of enhancing the capacity of lagoon -2 of Stage - I dyke by buttressing the existing dyke and then raising it peripherally up to 5m above the existing elevation. The proposed scheme will enhance the life of the existing Ponds of Lagoon 1 of Stage – I to several years.

2. DESIGN BASIS

2.1 The Existing Conditions of Lagoons 3A & 3B and Lagoon 2

The plan layout of existing Lagoon 2 of Stage I is shown in Figure 1. Adjacent to Lagoon 2, there exists Lagoon 1 as shown in Figure 1. The typical cross-section of existing dyke of Lagoon 2 with seven-raisings over the starter dyke (up to El. 120m) are shown in Figure 3. The existing conditions of the Lagoon -2 are:

Lagoon -2, Stage – I:

Starter Dyke - The crest of the Starter Dykes is at El. 99m ±. It is constructed with earthen materials with downstream (D/S) and upstream (U/S) sections of the embankment slopes at 2.5(H):1(V). The internal drainage system consists of vertical chimney drain and horizontal sand blanket and rock toe. The typical cross-section is shown in Figure 3.

1st Raising (R1) to 7th Raising (R7) – Seven raisings have been completed; R1 up to El. 102m ±, R2 up to El. 105m ±, R3 up to El. 108m ±, R4 up to El. 111m ±, R5 up to El. 115m ±, R6 up to El. 118m ±, R7 up to El. 120m ±. It is constructed with pond ash and covered with 500mm thick soil. The internal drainage system consists of vertical chimney drain, horizontal drainage blanket and rock toe with toe drain. The typical cross-section is shown in Figure 3. Presently this is charging.

Future Raisings – There is no provision for future raising over the 7th raising.

Lagoon 1, Stage – I:

Adjacent to Lagoon 2 there exists Lagoon 1 which is already raised to El. 120m in 7th raising after strengthening of the existing dyke. The buttressing work of Lagoon 1 is being done for capacity enhancement.

Decanting System

The slurry water and rainwater runoff from Lagoon 2 are evacuated by decanting well systems in to the overflow Lagoon (OFL -1). Similarly, slurry water and rain water runoff from Lagoon 1 is also evacuated by decanting well systems in to the overflow Lagoon (OFL -1). The slurry water and rainwater runoff from Lagoons of Stage –II are taken by decanting wells in to another overflow Lagoon (OFL -2). Finally, the de-sedimented water from OFLs are recirculated and pumped to the plant.

2.2 Site Constraints

Following are the site constraints and limitations of the facility developments:

- On north-east side, the common dyke of starter dyke of Lagoon 2 and OFL 1 exists for a length of about 1200 m ;
- On north-east side, the water pipe line passes very close to the toe of the starter dyke of Lagoon 2;
- On west side, Bankuli nallaha flows in between the dykes of Lagoon 2 of Stage I and dykes of Lagoons of Stage II. Generally, there is enough clearance between Bankuli nallaha and the D/S toe of starter dyke of Lagoon 2 of Stage – I dyke, however in certain portion, it is very close to the toe of the starter dyke;
- On west side of Lagoon 2 of Stage –I dyke, there is maintenance building closer to the D/S toe of starter dyke which cannot be shifted;
- Similarly, on the west and south sides of Lagoon 2, the pipe line corridor carrying ash slurry is closer to the D/S toe of starter dyke;
- On south side of the Lagoon 2, there is enough land available beyond the D/S toe, but the elevation of the ground is much higher (about 3m) than existing D/S toe;

2.3 Design Concept

The peripheral ash dyke design is based on the topographic map provided to the consultants by TSTPS. However, the topographic map was prepared around 2012 and since then quite a few changes have occurred in the original topography map. Therefore, some changes were made in the topography based on personal discussion with the engineers of TSTPS and the recent google maps provided by TSTPS. The information provided by TSTPS engineers of NTPC have been compiled in Annexures A and B.

The Peripheral Dyke design presented in this report has been developed in view of the above listed constraints. However, during the site visit it was discussed to remove some

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of the constraints to get more capacity enhancement as the dyke has already been raised to 7th raising over the starter dyke by U/S method of construction. It is our understanding that minimum 15m space would be available beyond the existing D/S toe for buttressing and capacity enhancement. Accordingly, the buttressing scheme design is developed assuming 15m (min.) space is available beyond D/S toe. The following are the measures to be taken by management of NTPC Kanhia for reducing the constraints:

1. 15m horizontal space will be available beyond the toe of the starter dyke and inside the OFL 1 so that the buttressing can start from inside the OFL 1 by building under water embankment with either rejected coal or boulders and aggregates;

2. On north-east side, the water pipe line will be shifted towards the NTPC boundary;

3. The course of Bankuli nallaha on west side will be diverted where space between the nallaha and the existing D/S toe is insufficient. About 30m space will be available on this side for buttressing after relocating the nallah where it is close to existing D/S toe.

4. On west side of the Lagoon 2, about 12m space is available between maintenance building and existing toe of the dyke. On this side, buttressing will start from the NGL keeping some margin between the maintenance office and the new toe of the buttressed dyke.

5. The pipe line corridor carrying 9 pipelines on west and south sides are to be relocated towards the NTPC boundary line.

6. On south side, the soil from the higher elevated ground will be excavated and the buttressing will start from the excavated NGL. About more than 30m space will be available on this side beyond the existing toe for buttressing. If needed alternative design for the same location can be given.

The buttressing of the dyke will continue up to El. 120m. After the buttressing of the dyke up to El. 120m is completed, dyke will be raised up to El. 125m. The buttressing

and the raising will be done with compacted pond ash covered with compacted earth. The portion of OFL-1 from which buttressing will start shall be constructed by creating a base with rejected coal/stone as shown in the sectional figure. The typical sections for the above cases are shown in Figures 5 through 9. The plan of buttressing, Peripheral Dyke and subsequent 5m raising are shown in Figure 2. However, the plan of Peripheral Dyke presented in this report and accompanying drawings and figures are quite flexible and can be shifted inwardly or outwardly as per the actual topography and other limiting constraints of the site. It is to be noted that the outwardly extension of the D/S toe of the proposed dyke would provide longer disposal volume of ash and also it can be raised further in the future.

The peripheral raising design of ash dyke is based on following consideration:

- As observed by Dr. C R Patra during the site visit in the year 2011 severe settlement occurred on the various raisings of dyke of south side of Lagoon 2. This was repaired by TSTPS. Otherwise, as reported all dykes have been constructed with the structural fill materials consisting of ash/soil and compacted to at least 95% Standard Proctor Dry Density (SPDD).

- However, during the site visit in the year 2014, Dr. Patra observed that settlement of the 1st and 2nd raisings have taken place and excessive pore water pressures developed in the dyke embankment. A scheme of strengthening of the dyke was then given by Dr. C R Patra and Dr. Umesh Dayal which was successfully implemented.

- Development of Plan-Layout: The actual site constraints and as built sections of the existing dykes have been reviewed and based on those considerations the plan layout drawings, sections and detailings have been developed.

- Geotechnical testing: The geotechnical properties of soil and ash of this site was provided by TSTPS during buttressing of the Lagoon 1 of NTPC Kanhia. This report was then reviewed and analyzed by the consultants and geotechnical design parameters were developed which were used in the design of buttressing of the Lagoon 1. Based on those test results, it was concluded that pond ash of this site is

suitable for construction of dykes to enhance the existing capacity of the lagoon. The Peripheral Dyke scheme presented in this report is based on those geotechnical parameters established for this site in the past.

- Buttressing and raising of ash dykes: Based on the existing site conditions as mentioned above and geotechnical design parameters established, design of the proposed buttressing scheme is presented in this report.

This report presents detailed design of strengthening and buttressing up to 7th raising (El 120m) and then additional raising of the 5m (up to El 125m). The report also includes the construction sequences, instrumentation; monitoring and maintenance, quality control program, guidelines for the preparation of technical specifications of selected items, and engineering analysis. The report includes all required details of figures and all notes so that NTPC engineers can prepare the detailed construction and contract drawings by incorporating them into their standard specifications.

2.4 Summary of Ash Disposal Facility Design

The design as presented herein is based on the site investigation and our previous experience in designing similar facilities in the vicinity of the project site. It is proposed to use the existing lagoon ash for constructing the dyke. This is considered to be very cost effective because the ash used for constructing the dyke would enhance the disposal capacity of lagoons. Also, the borrowed material is available at the site at no additional cost. In India, the use of ash for construction of dyke of ash lagoon is being strongly advocated because of its successful construction at several sites.

Five meter high Peripheral Dyke Raising along with buttressing have been proposed for this site which will ultimately raise dyke crest to El. 125 m from the proposed 7th Staged Crest El. 1200m ±. The proposed Peripheral Dyke shall be constructed by down-stream (D/S) method of construction, using lagoon ash in a controlled fashion above the existing embankment/ground surface. After constructing the buttressing up to El. 120m± the dyke will be raised up to El 125m± in the final stage.

At least 1.0 m of free board above the settled ash plus slurry water is to be maintained during entire period of operation of the facility. This will allow maximum settled ash

slurry levels of El. 124m. The existing decanting system (decanting well) should be raised in vertical intervals of 1m to maximum Elevation of 124 m ±. The ash embankment is provided with internal drainage system and is covered with 0.5m thick soil cover and vegetated to prevent the internal and external erosion respectively.

The proposed plan is flexible and can be suitably modified at any stage of the development.

2.5 Abandonment

At the completion of the filling of ash to Elevation of El. 125 m or any time prior to that stage, the facility could be abandoned by covering the impoundment with 0.5m thick soil cover, excavating a notch through the embankment crest, constructing the drainage channel, grouting the decanting system, grading the impoundment surface to drain towards abandonment channel and vegetating the entire area. The final plans for abandonment should be completed at the end of the operation when the actual as-built site conditions are established.

The recommended disposal plan provides storage for ash produced at TSTPS site to a maximum design El. 124m. The proposed plan is flexible and can be suitably modified at any stage of the development following the proper abandonment procedures.

3.0 ASH DISPOSAL PLAN

The ash disposal plan presented herein provides for the ash produced at TSTPS. This plan has been developed in accordance with sound engineering principles and current design practices. It satisfies the requirements of TSTPS as stated previously. The drawings showing the disposal plan have been sufficiently detailed and provided with necessary notes and construction sequences to aid TSTPS in developing the construction drawings and specifications as per their contractual requirements.

General - The general design concept of the Peripheral Dyke is based on following:

- 6m wide crest at Elevation 125 m;
- Typically the D/S buttressing and raisings are at D/S slope of 2.5 (H): 1 (V) at 6m vertical intervals with 6m wide bench.
- The U/S slope is 3 (H): 1 (V)
- Intermediate berms of 6m wide are provided at El. 87m, El. 93m, El. 99m, El. 105m, El. 111m, El. 117m, and El. 120m, where applicable.
- The portion of the pond where outer dyke is being raised should be inactive and preferably should not have any ponding of slurry/water.
- The construction of the Peripheral Dyke (buttressing) will begin from the NGL beyond the toe of starter dyke as mentioned above, and continue as an outside embankment (Down-Stream) construction up to the crest of 7^{th} stage raising of Ash Bund Elevation of 120m ±. Above the crest of ash bund 7^{th} stage raising the embankment shall be raised to El. 125m as a one unit. As shown in Figures (sections), chimney drains of various raisings are extended vertically upwards in specific cases.
- The maximum settled slurry level should be at-least 1m below the crest elevation (up to Elevation 124m).

- In the embankment construction, pond ash should be utilized as the main construction material.

- The ash embankment shall be covered with compacted earth of minimum 500mm thickness.

- The design is quite flexible so that, if required, the ash embankment alignment can be modified to actual site conditions.

- All the ash used in buttressing and dyke raisings and cover soils should be structural fill material compacted to at least 95% Standard Proctor Dry Density (SPDD).

- The ash should be discharged into the pond, by a series of discharge pipes in a garlanding fashion so that, the settled ash is distributed evenly along the periphery of the dyke.

3.1 Proposed Design

The existing dyke is not strong enough even to accommodate the present height. The consultant in his site visit has observed that there are settlements at various locations up to 3rd raising. The embankments of the dyke R1, R2 and R3 raisings are slushy up to 1/3rd heights because of very high pore pressure exists in the embankment due to blockage of chimney, blanket and toe drains. In the year 2014 consultants provided a design scheme consisting of relief wells for dissipating the pore pressure. It is presumed that this scheme was successfully implemented. Based on the additional land available beyond the D/S toe of the existing dyke the buttressing and peripheral dyke is constructed from the boundary limits of available space up to El. 120m. It is suggested that the Peripheral Dyke is raised from existing crest Elevation of 120m to Elevation 125m. The Plan layout of Buttressing and Peripheral dyke raising up to El. 125m is shown in Figure 2. The typical buttressing and subsequent peripheral dyke raisings up to El. 125m are shown in Figures 4 through 9. Figure 4 shows the section where the top of starter dyke of Lagoon 2 and the top of embankment of OFL 1 are at same elevation. There is no space available for buttressing the dyke in the OFL 1 area which stretches over 1.2 kms. The depth of water in OFL-1 varies from 1m near junction of OFL 1 and OFL 2 to about 8m at the other end.

However, if about 15 m space beyond the top of starter dyke towards the inside of Lagoon 1 will be available, then buttressing can be done from inside the OFL lagoon. TSTPS is assured to spare 15m of width within inside of the OFL lagoon along the D/S toe of Starter Dyke of Lagoon 2 to develop a platform by burying rejected coal ash/ boulders and aggregates. Figure 5 shows the section where buttressing starts from the natural ground level where the water pipeline passes close to the existing D/S toe. The pipeline corridor is to be shifted to avail the enough space for buttressing as discussed in the meeting with the managements of TSTPS. Figure 6 shows the section where there is a space constraint because of ash dyke maintenance building close to existing D/S toe. About 10m space is available beyond the existing D/S toe at this location for a short stretch. This space will be utilized for development of buttressing. Figure 7 shows the section where the pipe line crosses the Bankuli Nalaha. At some locations Bankuli nallaha is very close to the existing D/S toe and it is recommended to relocate the nallaha as shown in the Figure 2. It is not a perennial and very small nallaha and if it is relocated then a very large space can be utilized for buttressing. Figure 8 shows the section where enough space is available beyond the existing D/S toe but the ground elevation is much higher (about 3m) than the elevation of existing D/S toe. Accordingly, the ground over this portion shall be excavated to the level of existing toe and then used for buttressing. Consultants believe that removal of the soils for higher elevations can be stockpiled and reused for soil cover and the additional space created due to removal of the soils can be used for ash disposal. However, if TSTPS decides not to excavate the soil then consultants have provided an alternative conceptual design for buttressing in this area without removal to soils from higher elevations. Figures 8A and 8B show the conceptual layout of the alternative design. The detailed design can not be presented because it requires up-to-date topography of this area. Based on conceptual design TSTPS engineers can developed actual layout based on the on-site conditions during execution of the project.

Figure 9 shows the sections where the repairing of the dyke was made in the year 2011 after the serious settlement. It was repaired in the year 2011. Since then NTPC has faced no problem over this section. There is not enough space available as ash slurry pipe line corridor is closer to it. In order to start buttressing over this location, the pipeline corridor

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is to be shifted and TSTPS has agreed to relocate the pipe line. These specific cases of buttressing and dyke raising at plan locations A - A, B –B, C – C, D – D. E – E, F – F are shown in Figures 4, 5, 6, 7, 8, and 9 respectively. Figure 10 shows the section of dividing bund between Lagoon 1 and Lagoon 2. These sections and the typical cross-Sections provide all the design details of the proposed Peripheral Dyke buttressing and raising. Figures 11, 12, 13, and 14, respectively present details of the peripheral finger drains, cross-pipe connections, details of the slope drain connection with existing toe drain and details near D/S toe drain. The raising above the El. 120m is shown in Figure 15. Figure 16 shows the rock toe details with toe drain which shall be constructed at the toe of the peripheral/buttress sections of the dyke. Also at each berm level of the peripheral dyke rock toe shall be provided to divert the seepage water from the dyke body to the toe drain and finally to the chute drains (Figure 17 C). The chute drain is connected with the peripheral catch drain and finally to the toe drain at the toe of buttressed section. Figure 18 shows the Benching Details, which is intended to provide a good key and bonding between the interface of existing and proposed embankments. The benching is a key to provide good bonding between the existing and new surfaces. However, sometimes it may not be very practical to completely follow the details given in Figure 18. It is, therefore, emphasized that a good bonding between the two surfaces should be developed to the extent possible by excavating notches, offsets and scarifying the old surfaces prior to placement of new materials.

3.2 Design Feature

The following design features and activities, as related to buttressing of the Lagoon 2, are recommended:

1. **Retrofication of area beyond existing top of Starter Dyke in OFL-1 portion for buttressing construction in this area**

   In OFL-1 portion adjoining the starter dyke of Lagoon 2, buttressing embankment foundation and base would be developed by placing rejected coal/ boulders from the D/S toe to about 15m horizontal width up to the crest of the Starter Dyke. The following are the operations to be carried out.

   a. As far as practicable, the portion of OFL receiving buttressing shall be dry

b. Dump the rejected coal stacked at the site; in case of non-availability of sufficient rejected coal, boulders and aggregates may be used.

c. Compact the above material layer by layer filling with coarse aggregate and sand as filler, as needed.

d. After full compaction is made up to elevation 1.3m below the top of the crest of the existing crest of the starter dyke, all the voids of the rock/boulder/reject coal embankment are filled with coarse/fine aggregate to ensure that all protruding and sharp edges of the rock/boulder/reject coal are covered and well choked.

e. Place a layer of geotextile to separate the reverse filter from the rock/boulder/reject coal embankment packing. e, Place 500mm reverse graded filter above the geotextile. The reverse filter material should be hand held vibrating plate compactor to ensure the geotextile is not damaged or tearing apart.

f. On top of the reverse filter about 500mm good cohesive soil is placed and well compacted to 95% SPDD (min.) to form a good working pad.

g. The working pad is graded with D/S slope of about 2% to ensure good drainage.

h. Over it provide drainage blanket of 500mm thickness.

i. Install new rock toe (Figures 16).

2. **Construction of peripheral ash fill from NGL to 5m above existing top of the 7th raising i.e. up to El. 125m**

a. This new fill will be constructed in Six phases

b. Phase I construction from NGL up to El. 99m ±

c. Phase II construction up to El. 105m

d. Phase III construction up to El. 111m

e. Phase IV construction up to El. 117m

f. Phase V construction up to El. 120m

g. Phase VI construction (raising) up to El. 125m

h. Berms of 6m (min.) wide should be provided at Els. 99m, 105m, 111m, 117m and 120m

i. A 6m (min.) crest width should be provided at El 125m

j. Where the NGL is about 6m below El. 93m, an additional berm of 4m (min.) wide should be provided at El. 87m

k. The slope of D/S will be 2.5(H):1(V) and U/S slope will be 3(H):1(V)

l. Buttressing will be constructed with the pond ash excavated from nearby Lagoons and compacted to minimum 95% SPDD, and covered with 500mm (min.) of earth cover. Both earth and ash shall be compacted to minimum 95% of Standard Proctor Dry Density (SPDD).

3.2.1 General - The general design concept of the Peripheral Dyke is based on following:

- 6m wide crest at Elevation 125 m;
- Typically the D/S buttressing and raisings are at D/S slope of 2.5 (H): 1 (V) at 6m wide benches at vertical intervals of 6m
- The U/S slope is 3 (H): 1 (V)
- Intermediate berms of 6m wide are provided at El. 87m, El. 93m, El. 99m, El. 105, El. 111m, El. 117m, and El. 120m where applicable.
- The portion of the pond where outer dyke is being raised should be inactive and preferably should not have any ponding of slurry/water.
- The construction of the Peripheral Dyke (buttressing) will begin from the NGL beyond the toe of starter dyke as mentioned above, and continue as an outside embankment (Down-Stream) construction up to the crest of 7th stage raising of Ash Bund Elevation of 120m ±. Above the crest of ash bund 7th stage raising the embankment shall be raised to El. 125m as a one unit.
- The maximum settled slurry level should be at-least 1m below the crest elevation (up to Elevation 124m).
- In the embankment construction, pond ash should be utilized as the main construction material.
- The ash embankment shall be covered with compacted earth of minimum 500mm thickness.

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- The design is quite flexible so that, if required, the ash embankment alignment can be modified to actual site conditions.

- All the ash used in buttressing and dyke raisings and cover soils should be structural fill material compacted to at least 95% Standard Proctor Dry Density (SPDD).

- The ash should be discharged into the pond, by a series of discharge pipes in a garlanding fashion so that, the settled ash is distributed evenly along the periphery of the dyke.

3.2.2 New internal drainage system

a. Install inclined sand blanket drain (chimney drain) over the D/S slope of starter dyke and raisings (up to El. 120m) and horizontal sand blanket at 2% (min.) slope on the portion of the ground receiving buttressing beyond existing D/S toe. The thickness of these sand blanket drains shall be 500mm (min.).

b. Seepage water from the existing rock toe shall be collected at various levels providing peripheral finger drain along the toe drain and then connecting with cross pipe made of PVC from peripheral finger drain with "T" connection to discharge in to the toe drain of the lower slope.

c. Existing toe drain shall be filled with granular material up to the level of sand blankets and inclined blanket drains to be provided over existing slope (Figures 12, 13, 14). Since the bottom of existing toe drain is about 1.5m below the top of the bench, in order to minimize the use of river sand, peripheral finger drains (Figure 11) shall be provided as per the details given in Figure 12. Vertical sand chimney drain shall be provided from the existing 7th Raising at El. 120m to El. 125 (Figure 15). The thickness of vertical chimney drain shall be 500mm.

d. Horizontal sand blanket shall be provided at El. 120m which will be connected with the chimney drain as discussed above in 'c' (Figure 15). The thickness of such horizontal sand blanket shall be 500mm. Additional

horizontal sand blankets shall be provided to emerge at the different berm levels at El. 117m, 111m, 105m, 99m, 93m, 87m. (as the case may be).

e. New Rock toe (Figure 16) shall be provided at NGL and above ground level (i.e. at El. 87m, 93m, 99m, 105m, 111m, 117m, and 120m as the case may be). Height of the rock toe at NGL shall be 1.5m and at other levels it may be reduced to 1.0m height.

f. Proper surface drainage facilities like chute drains (details in Figure 17 c) and toe drains (Figure 17 b) and revegetation of embankment surfaces are to be provided to prevent erosion due to rainwater and seepage.

3.3 Construction Features

The main construction features of the proposed dyke construction are:

- The number of locations of decanting wells and spillways shall remain constant;
- Raise the existing decanting tower to El. 124 m in increments of 1m from the existing decanting well. The standard procedure of raising of decanting well as practiced by NTPC can be adopted;
- If the distance of the decanting wells is not far away from it, then it may be horizontally shifted outwardly as per NTPC's standard design practice.
- Raise the existing spillways as it was done for Lagoon 1;
- Construct the embankment from the NGL as mentioned in the sectional drawings;
- Construct 4m wide berm @ El. 87m and 93m
- Construct 6m wide Berm @ El. 99, El. 105m, El. 111m, El. 117m, El. 120m (as the case may be);
- Construct 6m wide Crest @ El. 125 m (min.);
- Construct U/S slope @ 3(H) : 1(V);

- Construct D/S slope of proposed embankment at 2.5(H) : 1(V) up to El. 125m, constructing 6m wide bench at 6m vertical intervals;
- Install 500mm thick vertical chimney Drain at locations as shown in Figure (15);
- Install 500mm thick drainage blanket at the interface of existing slope of the embankment prior to placing a new embankment materials. In areas where the existing slope is greater than 2%, it should be constructed at the existing slope. In areas where the minimum slope of the existing ground slope is less than 2%, the ground should be graded to 2% (min) slope prior to constructing the drainage blanket;
- Provide peripheral finger drains as per the drawings (Figure 11) provided;
- The new internal drainage system shall be made in coordination with the existing drainage system with reference to Figures 12, 13, 14, 15 and all sections shown in Figures.
- New rock toe drain should be constructed as per the details given in Figure 16 at locations where the proposed embankment is extended beyond the existing rock toe drain. Also the new rock toe are to be constructed at each berm level;
- Embankment material consists of ash compacted to minimum 95% Standard Proctor Dry Density (SPDD);
- The compacted ash embankment material shall be covered with 500mm soil cover compacted to minimum 95% Standard Proctor Dry Density (SPDD);
- Construct brick on edge on the Up-Stream slope;
- Provide turfing /vegetation on the Down-Stream slope;

3.4 Suggested Construction Sequence (for Details refer Guideline Technical Specifications)

The suggested construction sequence may be altered by the contractor to suite their construction scheduling, however, all the major construction items should conform to the guideline technical specifications given in this report.

1. As discussed and informed by NTPC, the pipelines carrying ash slurry and water will be shifted. The shifting of the pipelines carrying the ash slurry to the Stage – I Lagoons should be done to the extent possible in getting maximum space beyond the existing toe for developing buttressing.
2. Demarcation of the boundary of the NTPC area beyond the existing toe has been provided by TSTPS as shown in Figure 2. As per this figure the toe of the new peripheral dyke shall be demarcated at the site.
3. Excavate the highly elevated natural ground to receive the buttressing or follow the conceptual design as provided in Figure 8
4. The plan of Peripheral Dyke presented in this report and accompanying drawings and figures are quite flexible and can be shifted inwardly or outwardly as per the actual topography, property limit constraints, service requirements and upfront construction cost.
5. Prior to development of buttressing, the slope of the1st stage, 2nd stage, and 3rd stage raisings shall be provided with relief wells as per the scheme of strengthening provided in earlier report.
6. Remove all trees, bushes, grass and other organic materials and complete the surface treatment as per the surface treatment given in the specifications, to the extent practically possible.
7. Remove all soft/loose/organic materials from the area receiving D/S raising.
8. Proof-roll the entire area receiving D/S raising.
9. Construct 1m deep and 3m wide key at locations (at level of 99m, 105m, 111m, 117m below the construction of new embankment).
10. Extend all existing outlet storm drain pipes that were provided during interim strengthening of 1st raising
11. Install new storm drain pipes for conveying storm/seepage drainage.

12. All depressions or unevenness in the ground shall be filled up with bottom ash/pond ash and surface treatment with clayey soil.
13. The embankment is raised from the locations shown in plan layout and sections.
14. Extend the existing decanting tower as per the NTPC Standard design practice.
15. Install drainage blanket up to the location connecting the vertical chimney drain/sloping drain, consisting of coarse sand/bottom ash as per given specifications.
16. Construct ash embankment from D/S toe to El. 125m at 2.5 (H-Horizontal): 1(V-Vertical) with 6m (min.) wide bench at El. 120m, 117m, 111m, 105m, 99m and 4m wide bench is provided at El. 93m, and 87m as per the compaction criteria given in the specifications.
17. Raise ash embankment from El. 120m to El. 125m at upstream (U/S) slope of 3(H):1(V) and downstream (D/S) slopes of 2.5(H):1(V) as per the compaction criteria given in the specifications.
18. Install Vertical chimney drain connecting the drainage blanket as per the details given in Figures 4, 5, 6, 7, 8, 9, 12, 13 and 14.
19. Cover the entire exposed bench and downstream slope of ash embankment with 500mm (min.) soil cover as per the given specifications.
20. Cover upstream slope of the dyke with the brick packed on edge.
21. Revegetate D/S slope, all Berms, Embankment Crest and entire exposed areas.
22. Extend the existing outlet pipes (same diameter as it exists now) to remove the existing seepage/ discharge exiting from the D/S toe/rock toe. These conductor pipes should be constructed as the D/S raising progresses and should discharge well beyond the D/S toe of new raisings. While extending the existing pipes care should be taken to provide seepage cutoff collars and filter diaphragm at suitable locations as shown conceptually in Figure 22 The construction details of filter diaphragm and seepage cutoff collars are provided in Figures 24 and 25.

3.5 Major Construction Items

Major construction items are:

a) **Extension of Decant Tower:**

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The Existing Decant Riser should be raised in 1m intervals up to maximum Elevation of 124 m using the same construction details, material and size as used in the existing tower design. Alternatively, the existing decanting tower may be extended up to El. 124 m with suitable openings staggered around the periphery of the tower.

b) Extension of Horizontal Decant Pipe:

Where required, the existing decanting pipes used for the horizontal drain shall be extended on the D/S side as per NTPC Standard Design Practice. It should be NP 5 Hume Pipe. The pipe joints will be connected as per the industry standard. The initial section of pipe and each extension shall be tested to ensure that there is no leakage, prior to erecting the inlet or riser structures. Where buttressing begins above the Starter Dyke there is no need for the extension of the horizontal decanting pipe. However, two decanting pipes coming out from the two wells need to be extended as the buttressing in that portion will start from natural ground level beyond the D/S toe. Those two pipes should be extended beyond the downstream toe of the proposed peripheral embankment using the construction details, material and pipe size as follows or as per NTPC Standard Design Practice.

Pipe Installation

General : The pipe must be installed on an adequate foundation in a manner to preclude the possibility of excessive settlement and seepage along the outside of the pipe. All pipe installation shall be supervised by qualified personnel familiar with the intent of the design and knowledgeable of proper installation procedures.

Alignment : The pipe shall be placed on very stiff/dense natural soil as determined by the Engineer on the lines and grades, as shown on the Figure 23.

Pipe Installation : The decant pipe shall be installed in a trench. The trench shall be excavated to 250mm (minimum) below the pipe invert and at least 1.5m feet wide. The foundation bed of the trench shall be proof-rolled prior to installation of the pipe. The suggested procedure for pipe installation is given on Figure 23. The pipe shall be installed at 1 percent (minimum) grade sloping downstream.

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Pipe Connections : To provide a water-tight seal, the joints shall be connected by a qualified technician to withstand the design internal/external pressures without leakage and bulging.

Concrete Encasement : The pipe shall be encased in a reinforced concrete block of 1.5mx1.5m square. The remaining details are given in Figure 27.

Backfilling : The backfill above the encased concrete block shall be raised uniformly on both sides of the pipe in 15 to 20cm layers and compacted to 100 percent of Standard Proctor maximum dry density. The details are shown in Figure 26.

Materials for Backfill : Materials used for backfilling should be natural cohesive soils, free of any particles larger than 10cm in any dimension.

Pipe Outlet

Stone pitching of 10 to 20cm diameter shall be placed around the pipe outlet to aid in controlling erosion and scouring around the discharge point. The approximate discharge location is presented on the drawings.

Filter and Drainage Diaphragm

A filter and drainage diaphragm design has been provided to control seepage and limit particle migration along the decant pipe. The location of the diaphragm is presented on Figure 23 and detail of the diaphragm is presented in Figure 24. At the location of the filter drainage diaphragm, the pipe shall be coated with a bituminous material to minimize seepage between the filter material and pipe surface. The filter drainage material shall have the crushed stone or river gravel satisfying the filter criteria given in Section 8 of this report. A 50cmX50cm outlet drain shall be provided at one end of the filter diaphragm (approximately at decant pipe elevation), day lighting at the D/S toe of the embankment or connected to horizontal drainage blanket of the embankment. The outlet drain should be installed at 3% (min) slope to convey the seepage discharge from filter diaphragm to outside of the toe of the embankment or to horizontal drainage blanket of the embankment. The outlet drain consists of 15mm perforated PVC pipe encapsulated in 50cmX50cm crushed stone or river gravel.

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Soil Bentonite Cutoff

Two antiseep collars of soil and Bentonite mixture are to be constructed at the locations shown on Figure 23.The details for the antiseep collar construction are presented on Figure 25. After installation of pipe, the soil backfill should be excavated to the dimensions shown on the drawing and backfilled with the compacted mixture of Bentonite and moist soil (50/50 by volume) to the specified height and thickness.

The existing spillways shall be raised as it has been done in case of Lagoon 1 buttressing,

c) **Dyke Construction:** Suitable construction materials such as ash and soil (at designated locations) shall be used for the construction of dykes using lifts of 0.3m thickness and compacting with suitable compacting equipment to obtain a minimum field density of 95 percent of Standard Proctor dry density.

d) **Sub-surface Drainage:** A continuous internal drainage system shall be installed during peripheral buttressing and dyke raising of the outer embankment to collect the seepage through the body of ash embankment. The internal drainage includes construction of blanket drain, chimney drain/sloping drain, finger drains, collecting pipes and rock toe/flood protection drain at downstream faces of the dyke during the construction of all stages.

e) **Soil Cover:** Properly keyed 0.5 m thick compacted soil cover shall be provided all along the final contours of ash dyke construction. The keying detail is given in Figure 18.

f) **Slope protection with brick lining:** After construction of final soil cover over the ash embankment, the upstream slope of the dyke should be covered with the brick packed on edge and confined within the brick masonry panel walls at specified spacings.

g) **Surface Drainage:** A system to minimize erosion of dyke surface has been developed. This system includes the design of surface drainage facilities and a revegetation programme for completed ash retaining dykes. To facilitate removal of surface run-off from the embankment, catch drains should be provided at the

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perimeter of the toe. These drains are designed to safely pass the discharge and are provided with appropriate protection to minimize the potential of erosion of channels. This erosion protection includes brick lined catch drain, and/or concrete channels wherever necessary. These drains are connected to chute drain at 30m intervals over the entire embankment sections.

h) **Revegetation:** As the final surface of the embankment is completed, it should be revegetated to minimize the potential for erosion. The upper surface should be treated for turfing from direct sowing or from sod. To assure continuous stand of vegetation, a series of tests should be performed on the growth medium. These tests may include pH, electrical conductivity, lime requirement, available nitrogen, phosphorus, potassium and other essential plant elements suitable for local soil conditions. Based on these tests, the specific amounts and types of fertilizer, lime and other soil additives should be added to the local soil to establish an effective stand of vegetation.

3.6 Abandonment

After reaching the ultimate designed maximum crest EL. 125 m± or any time prior to this stage, depending upon the final configuration of the ash disposal facility, an abandonment plan may be carried out. Abandonment will involve covering of disposed ash with 0.5 to 1.0 m thick soil cover, grading the final deposited ash level to the proper slope for drainage, breaching the embankment crest (if necessary), constructing abandonment channels, grouting the decanting system (to eliminate the potential for piping due to degradation of pipe after abandonment) and covering the embankment surface with soil and vegetation.

Final abandonment provisions consisting of all the aspects should be completed prior to the end of disposal operation in the lagoon when the final contours of the disposal area are established.

4.0 INSTRUMENTATION

In order to monitor the performance of the ash dyke during construction and operation the following instruments should be installed at approximate locations shown in Figure 19 for ash dyke:

(a) Survey Monuments

(b) Piezometers

The fabrication and installation procedures of those instruments are given herein to facilitate the development of those instruments by TSTPS. Alternatively, commercially available standard model from the shelf may be used.

4.1 Survey Monument

In order to regularly monitor lateral movement, elevation and total settlement of the ash embankment, the cast-in-place survey monuments should be installed at the locations shown in Figure 19. The details of survey monument are shown in Figure 20. It primarily consists of 15 mm bronze head survey marker installed in concrete. At the location of monument installation, a 75 mm diameter hole is drilled with auger to 1.0 m depth. Pour the concrete to bottom 0.30 m. Install 15 mm ϕ survey marker of about 0.70 m length and pour the fresh concrete around it. The reading should be taken at intervals of one month for first six months after the construction of the dyke and thereafter at two months interval using theodolite or level and the elevations and the coordinates of top of the marker should be determined with reference to a standard benchmark located off the embankment area. The data should be recorded in the survey monument record chart (the sample of the record chart is shown in Table 1).

Table 1: Data Recording for Survey Monument

Typical Survey Monument Record Sheet

(a) Survey Monument Installation Data

Date	:
Survey Monument No.	:
Coordinate of Survey Monument	:
X	:
Y	:
Top Elevation of Survey Monument	:
Top Elevation of Survey Monument	:

(b) Survey Monument Recording data

Date	Top elevation	X-coordinate	Y-coordinate
*			

* Note: After every one month for first six months and after every two months for rest of the period

4.2 Piezometer

In order to monitor the piezometric level within the fill and lagoon perforated pipe piezometers should be installed at locations shown in Figure 19. The piezometer consists of black steel or plastic pipe, which extends from the tip to the top of fill as shown in Figure 21. The pipe shall have inside diameter of at least 38 mm and the bottom 1.0 m shall be perforated with approximately twenty five (25) uniformly staggered 3 mm ϕ holes.

The piezometer can be installed after construction of the embankment. Alternate installation procedures are shown in Figure 22, which can be utilized if the piezometer is installed while the construction is in progress. The sequence of construction is as follows:

i. After removal of ash from the lagoon to 0.5 m below the settled ash, drill a hole of at least 75 mm dia. to depth of 1.5 m.
ii. Place clean pea gravel or river gravel of 6 to 10 mm size to depth of 0.15 m in the bore hole.
iii. Place 38 mm slotted black steel pipe or PVC pipe in the hole with perforation at the bottom.
iv. Backfill around the pipe with 6 to 10 mm clean pea gravel or river gravel until the material covers the perforated length of 1.0 m of the pipe.

v. Place 0.25 m bentonite plug by pouring dry bentonite balls around the pipe and tamping with a steel rod.
vi. Backfill the hole with the material removed from drilling.

The piezometer pipe can be extended following extension sequence operation shown in Figure 22 and addressed as under:

a) Place a mound of ash approximately twice the height of lift and hand compact.
b) Place the first lift of the ash and compact it by appropriate equipment.
c) Construct the second mound around the pipe and hand compact.
d) Place the second lift of ash and compact it by appropriate equipment.

This sequence will continue until the final elevation is achieved. The top 1.0 m of pipe should be provided with 100 mm ϕ steel casing fitted with a cap having 3 mm dia. hole to serve as breathing hole.

The water level in the stand pipe can be measured to the accuracy of 0.01 m using several devices, including the plumb bob, cloth or metal surveyor's tapes coated with chalk or commercially available electrical indicators. The piezometer level should be taken at one week intervals after commencement of the ash slurry discharge in the lagoon. The data should be recorded in a piezometer record chart. The sample of the record chart is as shown in Table 2.

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Table 2: Data Recording of Piezometers

Typical Piezometer Record Sheet

(a) Piezometer Installation Data

Date	:
Piezometer No.	:
Coordinate of Piezometer Location	:
X	:
Y	:
i. Top Elevation of Piezometer Pipe	:
ii. Top Elevation of Tip	:
iii. Elevation of the bottom of hole	:
iv. Elevation of bottom of bentonite seal	:
v. Elevation of top of bentonite seal	:

(b) Piezometer Recording data

Date of recording	Depth of water	Elevation of water
*		

* Note: Once a week (variable)

5.0 MONITORING AND MAINTENANCE

5.1 Piezometers and Impoundment Level

Piezometers and the impoundment level will be read at least once a week and the data plotted on record copies of table and reviewed. Depending upon the water levels and frequency of change in water level, it may be necessary to increase or decrease the frequency of the readings.

5.2 Survey Monuments

Concrete monuments will be surveyed both in elevation and in plan at one-month interval for the first six months after the construction of embankment and thereafter at two months intervals.

5.3 General Observations

Critical observations of the ash slurry impoundment, the embankment (especially near the flow through embankment sections), the spillway discharge channel & appurtenant structures, and surface drainage facilities in the embankment area should be carried out every second month (bimonthly). In addition, the discharge through the flow through embankment sections should be monitored on a daily basis. Observations should also be made immediately after any unusual events such as floods, heavy rainfall, strong wind periods, abnormal structural embankment behaviour, etc. A report of the observations shall be reviewed at least semi-annually if the operation appears normal. Any unusual features shall be reported immediately to the expert geotechnical engineer. The observations will include, but not necessarily be limited to, the following:

- Embankment Slopes: Any irregularity such as scraps, wet areas, or sod disturbance shall be recorded.
- Working Disposal Surface: Any unusual irregularities shall be recorded.
- Berm and Surface Gutters, Perimeter Ditches, Spillway Discharge Channel: General condition of channels, soil erosion adjacent to or beneath riprap and seeded slopes, blockage by debris, etc., shall be noted.
- Decant System: General conditions at the outlet & inlet of the Decanting System on the U/S or D/S section, decrease or sudden increase in flow, etc., shall be noted.

- Vicinity of the Impoundment and the Embankment: General conditions throughout the area of the impoundment, along the perimeter of the embankment, shall be observed to note any changes which could be associated with the behaviour of the impoundment and the embankment

5.4 Maintenance

The following maintenance should be performed regularly:

- Routine maintenance: Continuous maintenance including reseeding, replacement of rip-rap or brick-lining of gutters and drains, removal of debris from the site, observations, and record keeping.
- Maintenance after unusual meteorological events (Heavy Rainfall, Severe Droughts, Floods, High Winds, etc.): The most important maintenance tasks at these times are the immediate backfilling of all erosion scraps and slumps and the repair and improvement of sod, drainage systems, riprap, brick-lining, and clearing debris from the invert of the decant pipe and drains.
- Maintenance after abnormal changes in behaviour of the structure: If abnormal behaviour of any portion of the impoundment of the embankment is observed, qualified geotechnical engineer familiar with the integrity of the facility should be consulted immediately and any recommended maintenance measure must be undertaken.

5.5 Data Review

All facility performance data, including piezometer readings, settlement readings, survey monument readings, and data obtained during periodic inspections and maintenance, should be reviewed by an experienced geotechnical engineer, knowledgeable of the facility construction and disposal requirements, including the design recommendations presented in this document.

5.6 Record Keeping

All facility performance data, including as built drawings, piezometer, settlement and survey monument readings should be properly maintained.

6.0 QUALITY CONTROL PROGRAM

6.1 Ash Borrow Area

Tests :

a) In-situ moisture content

b) Standard Proctor test to establish moisture density relationship.

c) Compaction moisture content (prior to dumping at site).

Samples **:** One sample should be collected on a 75 m grid at the depth intervals of approximately 0.9 m which will provide a minimum of one sample every 5000 cu.m. of ash.

6.2 Soil Borrow Area

Tests :

(a) Grain size analysis

(b) Standard Proctor Test - to establish moisture density relationship

(c) In-situ moisture content

(d) Compaction moisture content (prior to dumping at site)

Samples : One sample should be collected on a 75 m Grid at the depth intervals of 0..9 m which will provide a minimum of one sample every 5000 cu.m. of soil.

6.3 Test-Fill Section (All tests as per I.S. 2720)

(1) In-situ density 10 Nos.

(2) In-situ moisture content 10 Nos.

Acceptance Criteria **:** 95% of maximum Standard Proctor Dry Density (I.S. 2720) for all tests

6.4 Foundation after preparation

Tests : In place density and moisture test (I.S. 2720)

One test for every 5000 sq.m. of foundation area or part thereof.

Acceptance : 95% of maximum Standard Proctor Dry Density (I.S. 2720).

6.5 Field Density Tests for Ash Embankment and Soil Cover

Tests : In place density and moisture test (I.S. 2720)

Number of tests : Following minimum test schedule should be followed :

(1) One test for every 5000 cu.m. of ash placed or part thereof for embankment construction.

(2) One test for every 5000 cu.m. for earth or part thereof.

(3) Once for every5000 sq.m. of area on the trimmed slope.

(4) Once for every 250 m length of dyke in each layer.

(5) At least one test for every full or part shift of compaction operations.

(6) One test whenever there is a definite suspicion of a change in the quality of moisture control or effectiveness of compaction.

(7) The entire configuration of the soil cover should be vegetated immediately after construction of each stage.

Acceptance: 95% of Maximum Standard Proctor Dry Density (I.S. 2720).

6.6 Analysis of Control Test Data

Compare each field determination of moisture and density with appropriate compaction curve to evaluate conformance to requirements.

(a) Statistical Study

Overall analysis of control test data will reveal general trends in compaction and necessity for altering methods. Inevitably, a certain number of field determinations will fall below specified density or outside specified moisture range. Tabulate field tests, noting the percentage difference between field density and laboratory maximum density and between field moisture and optimum moisture content.

(b) Moisture Control

Close moisture control is evidenced if two-thirds of all field values fall in a range ±1 percent about the median moisture content specified. Erratic moisture control is evidenced if approximately two-thirds of all field values fall in a range ± 3 percent about the median moisture content specified. To improve moisture control, blend materials from wet and dry sections of borrow area.

(c) Compactive Effort

Suitable compaction methods are being utilized if approximately two-thirds of all field densities fall in a range of ± 3 percent about the percent maximum density required. Insufficient or erratic compaction is evidenced if approximately two-thirds of all field values fall in a range of ± 5 percent above the percent maximum density required. To improve compaction, consider methods for more uniform moisture control, alter the number of passes, weights, or pressure of compaction equipment.

7.0 GUIDELINE TECHNICAL SPECIFICATIONS

7.1 Horizontal Pipe Construction

Select the alignment of hume pipe. Excavate the pipe alignment trench to required bottom elevation at side slope of 1 horizontal to 1 vertical. Proof rolls the entire trench bottom with vibratory plate compactor or other suitable compaction equipment.

Scoop out pockets of about 300 mm X 300 mm X 300 mm size on both faces of the excavated slope at 1 m c/c (staggered) to ensure proper bonding with the future placement of earth.

Place 150 mm thick soil layer (compacted thickness) on the entire trench width and compact it with plate compactors, tamping or by any other suitable method to achieve a dry density not less than 100 per cent of Standard Proctor Dry Density.

The material for filling around pipe shall be locally available clayey soil (ML or CL) with plasticity varying from 7 to 20. Install the hume pipe as per manufacturer's guidelines and then fill the entire trench with clayey soil in layers of 150 mm (compacted) and compact it with vibratory plate compactors or tamping or by any other suitable means to achieve a dry density not less than 100 percent of Standard Proctor Dry Density. Figures 23 through 27 provide the construction details for horizontal pipe extension.

Cut off Collars: No RCC cut off collars need be provided. Only flexible cut off collars (earth and bentonite powder mixed in equal proportion) shall be used to make the cut off-collar. The cut -off collar shall be provided at location shown in Figure 23as per the details given in Figure 25. The cut off collar shall be 500 mm thick and shall project by 2.0D (minimum) around from the pipe encasing. (D=outside diameter of the pipe). The excavation shall be done vertically, by providing necessary sheeting arrangements. The excavated trench shall be filled up with a well compacted bentonite mixed earth (earth and powdered bentonite mixed in equal proportion) in layers of not more than 150 mm thickness. After placing the soil bentonite, the casing shall be gradually pulled up to see that the earth is compacted without any gap in the shuttering locations.

Filter Diaphragm: A filter diaphragm, 500 mm thick, 6D wide shall be provided at location shown in Figure 23, with graded sand/bottom ash material satisfying the filter criteria for the surrounding base material. The construction details of Filter diaphragm is provided in Figure 24.

The excavation for the filter diaphragm shall also be done vertically, by providing suitable sheeting. The filter material shall be placed in the trench in horizontal layers of compacted thickness 150 mm and thoroughly compacted by ramming. The diaphragm filter shall be suitably connected to the sand/bottom ash blanket drain to route the discharge, if any, through the filter diaphragm.

Above the 600 mm thick earth cover over the pipe encasement, vibratory rollers may be used to compact the ash or soil layers for construction of ash dyke.

Provide Stone pitching of 10 to 20cm diameter around the pipe outlet to aid in controlling erosion and scouring around the discharge point.

7.2 Dry Ash Embankment Construction

7.2.1 Material

For constructing peripheral embankment mainly pond ash will be used. However, the side embankment material and the bottom portion of the valley shall be filled with granular filter material. The recommended in place moisture content of the ash fill should be within 0 to (-5) percent from the optimum moisture content, unless the field trials have demonstrated a different practical value.

Excessively wet pond ash from the lagoon should be hauled and spread in non-overlapping piles and allowed to drain before being transported to the embankment construction site. If the pond ash contains any lumps, as might be the case with stockpiled pond ash, it may be necessary to till the pond ash with a rotary tiller or similar equipment to break down the lumps. The maximum lump size should not exceed 0.09 m. In order to complete the construction quickly, the pond ash should be deposited in stock piles and then used.

7.2.2 Spreading and Compaction

The stockpiled pond ash should be dumped from end-dump or other earth moving equipment. The material should be spread by means of dozer or other earth moving equipments in nearly horizontal lifts of 0.3 m (loose) thickness. The spreading should be on the entire width of the embankment and the length should not exceed 120 to 180 m at one stretch. After spreading, the material should be immediately compacted with suitable compacting equipment to number of passes established from the test-fill section

(discussed later) to obtain a minimum in-field density of 95 percent of the Standard Proctor dry density obtained in laboratory for selected fill materials.

7.2.3 Benching

In areas where pond ash/soil embankment fill is placed on the top of the existing embankment, adjacent to natural soil or compacted soil or soil embankment (slope and side abutments of existing dykes, soil embankment), the slope should be benched at approximately half-meter elevation interval to ensure that the new pond ash filling or soil embankment at ends is properly tied and keyed into the existing slopes. The prepared surface should be scarified to a depth of at least 0.15 m. The benching details for bonding two embankments are given in Figure 18.

7.2.4 Laboratory Tests

Since either pond ash/soil likely to be used in this project would be from several locations within the lagoons, it may be necessary to perform the Standard Proctor Density Test as per the recommendations of Indian Standard (I.S. 2720) to establish the moisture density relationship of the samples collected from the same area of the lagoon from where the soil/pond ash is likely to be used for construction. It is recommended that the test should be performed for every 5000 cu.m. of borrow pond ash/soil material. If the results are scattered, it may be necessary to use a mean maximum dry density and moisture content of each sample in proportion to the anticipated fraction of the total fill materials coming from each lot. The mean maximum dry density and optimum moisture content then should be used for determining the required compaction.

7.3 Ash Dyke Construction

7.3.1 Removal of water within construction area

The entire embankment foundation area receiving the fill should be dewatered before the placement of ash. It is generally achieved by synchronizing the construction schedule in such a way that when the construction is in progress, the slurry is being discharged in the other pond. It is therefore suggested that suitable modification may be initiated immediately in ash disposal plan so that during the construction of the Ash Bund expansion, the pond is maintained dry. In case of heavy rain or in unavoidable circumstances, dewatering may be achieved by constructing suitable

slope on the construction area for removal of surface run off. A high perched water table may exist at a shallow depth (below the ash surface) due to accumulation of slurry and in such situation suitable measures should be adopted as given in section 7.3.5.

7.3.2 Surface Treatment of Natural Soil / Existing Earthen Embankment

The natural soil or existing earthen embankment surface areas receiving ash should be treated to ensure satisfactory foundation beneath the ash fill. This includes the removal of all vegetation, excavating the top 0.15m of soil and stock piling for later use as a cover soil. Prior to placement of an ash/soil lift, the area should be prepared with chain mounted Dozer/Excavator to create rough surface and then again moistened.

7.3.3 Surface Treatment of Lagoon Ash

The lagoon ash surface areas receiving ash for embankment construction should be treated to ensure satisfactory foundation beneath the ash-fill. This includes the removal of all vegetation, excavation of top 0.5 m of ash between the upstream slope of existing earthen dyke and the edge of upstream end of the plan area of the proposed ash embankment. Beyond the upstream edge of the proposed embankment, the excavation should be extended up to 2 m projecting from the edge of the slope at an average slope of 4(H):1(V). All ash removed may be stock-piled for reuse in the embankment construction. All the excavation within the ash lagoon should be at a minimum slope of 4 (horizontal): 1 (vertical). The excavated surface, if dry, should be wetted and then compacted with suitable compacting equipment to achieve the required density of 95 percent of Standard Proctor Dry Density. Prior to placement of ash lift, the area should be prepared with chain mounted Dozer or excavator to create a rough surface and then again moistened.

7.3.4 Material

For the ash embankment construction, both pond ash and dry ash can be used. If bottom ash, cinders & slags are also available they may be used with pond ash for embankment construction. No specific blending or mixing of the material is recommended but the NTPC should take precautions to evenly distribute the cinders,

slag and other large sized particles to obtain good compaction. Below the water table the excavated portion of the construction area may be filled with bottom ash, cinders and slags to achieve good constructability condition. Once the working pad is formed to some reasonable height (about 60cm) above the water table then the maximum percentage of cinders and slag should be limited to not more than 20 percent of flyash and bottom ash.

The lagoon ash is generally close to optimum moisture content upon excavation from the pond and has a very flat moisture-density curve. It is, therefore, not meaningful to specify any specific moisture content other than to specify that it be such that the required density can be obtained. The recommended in place moisture content should be within 0 to (-5) percent from the optimum moisture content, unless the field trials have demonstrated a different practical value.

It has been shown that the shear strength of ash is affected by the ash density and moisture content. The undrained shear strength decreases significantly in ash sample compacted on the wet side of the optimum. The study also indicated that the partially saturated samples of ash tend to be less compressible than fully saturated samples. Therefore, it is desirable that the material should be at or below optimum moisture content. Excessively wet ash from the lagoon should be hauled and spread in non-overlapping piles and allowed to drain before being transported to the embankment construction site. If the ash contains any lumps, as might be the case with stockpiled ash, it may be necessary to till the ash layer with a rotary tiller or similar equipment to break down the lumps. The maximum lump size should not exceed 0.09 m.

7.3.5 Spreading and Compaction

The stockpiled ash should be dumped from end-dump or other earth moving equipment. In the rainy season, the ash should be dumped in the central portion of the embankment, away from the slope during rain and near the slopes during dry periods. The ash should be spread by means of dozer or other earth moving equipments in nearly horizontal lifts of 0.3 m (loose) thickness. The spreading should be on the entire width of embankment and the length should not exceed 120 to 180 m at one stretch. After spreading, the ash should be immediately compacted with suitable compacting equipment to number of passes

established from the test-fill section (discussed later) to obtain a minimum in-field density of 95 percent of the Standard Proctor dry density obtained in laboratory for soil and ash materials and for slag and cinders, the field relative density should be 65 percent above the water table. Below the water table no specific relative density criteria is recommended because it is difficult to monitor in the field with conventional density measuring systems. However, it is suggested that the in-placed materials below the water table should be well compacted (at least 6 passes) to form a good working platform. Stockpiled ash can vary greatly in moisture content depending upon its location in the stockpile. Therefore, some adjustment of moisture content may be necessary prior to compaction.

7.3.6 Laboratory Tests

Since ash likely to be used in this project would be from several locations within the lagoons, it may be necessary to perform the Standard Proctor Density Test as per the recommendations of Indian Standard (I.S. 2720) to establish the moisture density relationship of the samples collected from the same area of the lagoon from where the ash is likely to be used for construction. It is recommended that the test should be performed for every 5000 cu.m. of borrow ash material. If the results are scattered, it may be necessary to use a mean maximum dry density and moisture content of each sample in proportion to the anticipated fraction of the total ash coming from each lot. The mean maximum dry density and optimum moisture content then should be used for determining the required compaction.

7.2.7 Test-Fill Section

It is recommended to develop a performance specification for compaction by means of a test-section prior to full scale construction. The test fill section can be a part of the proposed ash embankment and may be constructed on the top of the settled slurry ash bed. By trials, develop a definite compaction procedure, lift thickness, moisture application and number of passes which will produce the specific density (dry density of 95 percent of Standard Proctor Dry Density for soil and ash material and relative density of 65 percent for slag and cinders). The test-fill section may cover an area of approximately 15 m x 8 m of about 2 m height. The construction should be carefully monitored to study the density-moisture relationship of compacted ash. The number

of passes of a particular piece of compaction equipment required to achieve the desired density of the ash from a particular source is determined. If the ash used is from more than one location, the number of passes required for each ash is taken in proportion to the total ash coming from each source and the resulting mean number of passes is applied to the compaction of all the ashes.

7.3.8 Compaction Equipment

The most satisfactory compaction results for ash embankment have been achieved with self-propelled pneumatic-tired rollers and vibratory rollers. Following are basic specification for ash compaction equipment:

A. Pneumatic Rollers

Pneumatic rollers with four wheels and equipped with pneumatic tires, and ballast loading of the order from 10000 to 12000 kgs are suitable for flyash compaction. The tires shall be of such size and ply as can be maintained during rolling operations, a tire pressure not greater than 2.5 kgs/sq.cm for a 11000 kgs wheel load. All the wheels should exert approximately equal loads, when traversing uneven grounds. The spacing of the wheels shall be such that the distances between the nearest edges of adjacent tires at the imprint will not be greater than 50 percent of the width of single tire.

B. Vibratory Rollers

Vibratory rollers shall have static linear load 31 to 38 kg/cm (dead weight 10 to 12 tones) and the vibrators shall have frequency between 1100 and 1800 pulses per minute and amplitude of vibration shall be between 0.5 mm and 1.7 mm. For a small production rate (viz. localized construction) small vibrating rollers with dead weight of approximately 1500 Kg may be used. NTPC may opt to utilize the combination of both small size (1500 Kg) and large size (10 to 12 tons) vibrating rollers. For initial few lift above the settled slurry ash bed, small size rollers may be used and when the embankment is sufficiently raised above the settled ash, the large size rollers may be used. If more than one roller is used, the performance specification should be developed for each type of rollers. Heavier models tend to over stress the ash surface or may tend to bog down. In confined areas, hand-held impact rammers with a large

foot provide satisfactory results. It may be noted that the sheeps-foot rollers, smooth wheeled rollers and vibrating plates have not been successful on ash.

Due to lack of standardization of Indian compaction equipment, it is recommended to use one of the above proposed equipment and the suitability of equipment be verified on a test strip prior to actual construction. One of such equipment is the Escort model EC 5250 which has been used at several sites in the Korba area. Previous experience has shown that the compaction increases with additional passes of the rollers. Based on the test-strip trials, the actual compaction criteria should be established for dyke construction.

7.3.9 Soil Cover

Many ash embankments in past have failed due to erosion. Ash is a very erosive material and susceptible to severe erosion if not properly treated. There are many ways by which the erosion of ash can be prevented. One of the most commonly used techniques is to cover the ash embankment with non- erodible soil. The soil cover when vegetated with grasses and legumes, besides preventing the external erosion, provides an aesthetic appearance.

At TSTPSAsh Bund site the ash embankment should be covered with minimum of 0.5 m thickness of natural soil excavated from borrow area. The 0.5 m thickness is sufficient to prevent erosion of the ash embankment if good vegetation is provided. However, if large amount of cover soil is available nearby the construction site, TSTPS may consider increasing the thickness of the cover material to 0.75 m or more, if economically viable.

The soil material used for the cover should be non-erodible and capable of supporting vegetation and plantation when placed over ash embankment. The specification for the Borrow Material is given in Section 7.3.10. The cover soil shall consist of sand/bottom ashy loam free of admixture of stiff clay, refuse, stumps, roots, rock, bush, weeds or other material which would be detrimental to the proper development of the vegetative growth. The minimum and maximum pH values shall be 5.5 and 8.0, respectively. The soil should preferably have the following grading: Sand/bottom ash (20-75%), Silt (10 - 60 %), Clay (5 - 30 %). It should not contain stones, 25 mm

and over in diameter. The loamy top soil is known to be of good quality and reasonably free draining which is demonstrated by the occurrence of healthy crops, grass or other plant growth.

The soil cover can be constructed in two ways as explained in Section 7.3.11. The first method is to spread and compact the soil on the sides of ash, lift by lift, as the ash layer itself is constructed. This method works well for thick layer of soil. The second, most suitable for thin top soil cover, is to over construct the ash slopes and trim back to appropriate slopes upon completion of last layer. Since the polished surface can be created by the trimming process, the trimmed surface should be scarified with a drag line bucket. A 0.5 m thick soil cover is then constructed on the slope. The soil layer should be placed in lift thickness not exceeding 0.20 m and compacted with suitable compacting equipment to achieve at least 95 percent of Standard Proctor dry density. The TSPTS should select the appropriate equipment to achieve the required compaction. For performance evaluation of the selected equipment, a test section may be developed to establish the criteria for the compaction of the cover material. Necessary laboratory tests should be performed on the borrow soil material to establish moisture density relationship and the field moisture content should be within ±2 percent. The final finished cover surface should be dressed and loosened by suitable agricultural equipment to provide a good bond and to hold 0.15 m thick surface dressing of a good top soil. The downstream slope, including berms(s), should be turfed. The turfing may be developed by direct sowing or from the sod. The upstream edge of the crest should be protected by "dowla" and the upstream slope should be covered with dry brick pitching for protecting the external erosion of the slope.

For direct sowing the growth medium should be tested for pH, electrical conductivity, available nitrogen, phosphorous, potassium and other essential plant elements to assure a continuous stand of vegetation throughout the life of facility. From these tests, specific amounts and types of fertilizer, pyrite and other soil elements required to establish an effective stand of vegetation can be determined. Species and seeding rates of grasses and legumes to be planted should be selected based on the characteristics of the prepared growth medium. Seed bed preparation, seeding,

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mulching and other operations required to establish an effective stand of vegetation should be subsequently conducted in such a manner as to optimize plant growth and minimize erosion.

Alternatively, the turf can be established from the sod. The sod shall consist of dense, well rooted growth of permanent and desirable grasses, indigenous to the locality where it is to be used, and shall be practically free from weeds or other undesirable matter.

7.3.10 Borrow Materials:

a) Material required for the earth cover shall be brought from approved borrow areas arranged either by the NTPC or by the contractor as per the contract.

b) The borrow area should be selected so that it is free from any organic soils, ponded water, lake/river bottom soils and any other debris. The borrow area preferably should consist of one of the following soil types:

GM - Silty gravel, poorly graded gravel, sand/bottom ash silt mixture

GC - Clayey gravel, poorly graded gravel-sand/bottom ash-clay mixture

SC - Clayey sand/bottom ash, poorly graded sand/bottom ash-clay mixture

SM - Silty sand/bottom ash, poorly graded sand/bottom ash-silt mixture

CL - Inorganic clay of low to medium plasticity, gravelly clay, sand/bottom ashy clay, silty clay

MI - Silty or clayey fine sand/bottom ash with intermediate plasticity.

The Plasticity Index (PI) of the soil should preferably be between 7 to 15.

c) The depths of cut in all parts of the borrow areas will be determined by the engineer depending on the site condition and the cuts shall be made to such depths only.

d) Borrow area shall not be opened within a distance of five times the height of embankment contiguous to the head or the toe of the embankment or 100 meter, whichever is more. Borrow area shall be operated so as not to impair the usefulness or mar the appearance of any part of the work or any other property. The excavation surfaces and surface of waste materials shall be left in a reasonably smooth and even condition.

e) Preparation of borrow area (site clearance): All areas required for borrowing earth for embankment cut off construction shall be cleared of all trees and stumps, roots, bush, rubbish, and other objectionable material. Particular care shall be taken to exclude all organic matter from the material to be placed in the dam embankment.

f) Stripping of borrow area: Borrow areas shall be stripped off top material, sod and any other matter which is unsuitable for the purposes for which the borrow area is to be excavated. The depth of stripping shall be decided by the NTPC depending upon the nature of top material.

g) Borrow area watering/dewatering: The natural moisture content of material in the borrow areas as well as the optimum moisture content corresponding to the maximum dry density (Standard Proctor) for the material in the particular borrow area shall be obtained from laboratory tests. Additional moisture, if required, shall be introduced into the borrow area by watering well in advance of excavation, to ensure uniformity of moisture content. If in any borrow area before or during excavation, there is excess moisture, steps shall be taken to reduce the moisture by the selective excavation to secure the materials of required moisture by excavating drainage ditches, by allowing adequate time for drying or by other means. To avoid formation of pools in the borrow areas during excavation operations, drainage ditches from borrow areas to the nearest outlets shall be excavated.

7.3.11 Suggested Construction Sequence of Soil Cover

(a) Soil cover constructed simultaneously with ash embankment

i. Select the borrow area(s).

ii. From the Standard Proctor test, establish the maximum dry density and optimum moisture content and accordingly select the density requirement for 95 percent compaction.

iii. Select the compaction machinery to be used for soil cover.

iv. From the test strip develop the compaction criteria for 95 percent compaction of cover soil.

v. Spread and compact the soil cover on the sides of ash, lift by lift, as the ash layer itself is constructed.

vi. The final surface is loosened to provide good vegetation.

vii. Establish the vegetation on the entire slope, benches and berm.

(b) Soil cover constructed after the ash embankment

i. Select the borrow area(s).

ii. From the Standard Proctor test, establish the maximum dry density and optimum moisture content and accordingly select the density requirement for 95 percent compaction.

iii. Select the compaction machinery to be used for soil cover.

iv. From the test strip develop the compaction criteria for 95 percent compaction of cover soil.

v. Trim the ash slope to the required lines and grades.

vi. Moisten the slope area receiving the cover soil and place 0.20 m lift of uncompacted layer of cover soil and compact as per the compaction criteria established from the test-fill section

vii. After completion of the first layer of the cover soil on the entire slope areas, place successive layers, and compact so that the final cover layer has a minimum compacted layer of 0.75 m thickness after dressing.

viii. The final surface is loosened to provide good vegetation.

ix. Establish the vegetation on the entire slope, benches and berm.

7.3.13 Slope Protection with Brick Lining

The following technical specification may be used. The entire upstream embankment slope shall be covered with one layer of dry packing of brick on edge, confined within brick masonry panel wall. To provide the lateral support to the panel wall, a 22 cm thick masonry wall should be constructed at the toe of upstream embankment slope to required height. The brick panel wall should be constructed at suitable intervals. All bricks of the panel wall should be laid on full mortar beds and have all vertical joints completely filled and slushed up with mortar. The gap between the wall and the panel should be kept as minimum as possible and then it should be filled up with earth, watered and well rammed before placing the dry brick packing. Prior to laying of the dry brick in the panels, the earth surface shall be rammed and leveled and then packed with the bricks on edge starting from lower corners of the panel to the other areas of the panel in 'Herringbone'

bond fashion. The bricks should be tightly packed by tapping with a wooden mallet and any gap, if left, between the bricks should be filled with broken bricks.

7.4 Internal Drainage System

The internal drainage system consists of rock toe, toe drain, drainage blanket, sand chimney drain, peripheral finger drain and cross pipes. Internal drainage system shown in drawings primarily consists of compacted granular material to reduce the piezometric surface on the downstream slope of the dyke. The size and thickness of the internal drainage system should be as per the details given in the accompanying figures/drawings.

This section of the specification covers supplying and forming of sand/bottom ash blanket, sand/bottom ash chimney, trench drain, sand/bottom ash filters around rock toe and toe drain, as indicated in the drawings.

7.4.1 Filter Material

The material for blanket and chimney drains and sand/bottom ash filters and around the rock toe shall consist of clean, sound and well graded coarse sand. The material shall be free from debris, wood, vegetable matter and other deleterious matter. The gradation of each filter layer shall meet the requirements as specified below:

a) (D_{50} of filter) / (D_{50} of base material) < 25

b) (D_{15} of filter)/ (D_{15} of base material) = 6 - 19

c) (D_{15} of filter)/ (D_{85} of base material) < 5

d) The gradation curve of the filter material shall be nearly parallel to the gradation curve of the base material.

e) The filters shall not contain more than 5% by weight of materials finer than 0.075 mm size.

f) The sand/bottom ash filter layer shall be considered as the base material for aggregate filter layer.

g) The filter material shall be suitably compacted to a firm condition to achieve a relative density of 70%.

h) In addition to the above, the provisions for filter as given in "I.S. 9429-Code of practice for drainage system for Earth and Rock Fill Dam", shall also be followed.

7.4.2 Filter Placing

(i) Sand Blanket

Sand/bottom ash blanket shall be laid subsequent to site clearance, stripping and excavation and cut off trench filling, if any, and foundation preparation. The prepared area shall be approved before laying the blanket material. Water as found necessary shall be sprinkled before compaction. Extreme care shall be taken when placing materials in the zone to obtain a fill free from lenses, layers and streaks of segregated materials.

(ii) Sand Chimney

Sand chimney of specified thickness shall be laid at the specified location by excavating and removing the already compacted bund material, exposing the sand/bottom ash chimney in the lower layers earlier laid, and refilling the trench with sand/bottom ash in layers. The layer of sand/bottom ash shall be well watered and rammed. The depth of each layer of chimney to be laid shall not be more than 15 cm or as directed by the Engineer. The excavated material can be reused in the bund area.

Alternatively, the sand/bottom ash chimney can also be laid in layers simultaneously with the laying of each layer of fill. In such case, the top level of sand/bottom ash layer shall always be kept at about 100 mm above the earth level on both sides. Each layer of sand/bottom ash shall be well watered and rammed. Care shall be taken to avoid mixing of soil and sand/bottom ash.

(iii) Sand Filter

The sand/bottom ash filter underneath the rock toe and between rock toe and the bund shall closely follow the levels of the embankment in the area. The sand/bottom ash filter material shall be clean, sound, durable and well graded.

7.4.3 Rock Toe and Rock Fill

Rock toe shall be formed with rock material consisting of sound, durable and well graded broken rock obtained from approved quarries and shall be of special quality. The materials shall range in size from 10 to 45 cm. All bushes, roots or other perishable materials shall be removed from rock-fill during spreading.

The placing of rock toe shall be such so as to obtain a stable, well graded and free draining fill. The rock toe shall be constructed in layers so that the smaller rock fragments shall be placed adjacent to the filter of embankment and the large rock fragments near the outer edge of the rock toe or on D/S face of the embankment. The rock fill shall be hand placed, spread and roughly leveled and compacted in layers not greater than 30 cm in thickness in order to maintain a reasonably uniform surface and ensure that the completed fill will be stable and not contain any voids having dimension larger than 40 mm. All voids shall be filled with the crushed rock, river gravel and coarse sand/bottom ash.

Contamination of the rock with finer materials from any other zones shall be avoided. Accumulations of soil caused by contamination shall be removed. Rock materials shall not be dumped directly against any concrete or masonry structure, but shall be hand placed in layers.

The top surfaces and the exposed slope of the completed rock toe shall be temporarily protected with a plastic sheet or jute cloth to prevent clogging of voids in the rock toe due to ash/earth etc. during the period of construction of the dyke. The protective layer shall be removed before discharging slurry into the lagoon.

The catch drain shall be constructed in rough stone brick packing, 15 cm thick on the opposite side of the rock toe and at bottom. It shall have a minimum depth of 0.3 m. For drains on the berms, suitable bed slopes shall be provided for efficient drainage.

7.4.4 Geotextile

Nonwoven geotextile MGIPL 60, manufactured by Maharshee Geomembrane
or equivalent should be used The product specification is given below.
Nonwoven geotextile MGIPL 60 should be used. The following specifications shall be adopted.

Material for Geo-textile filter - 100% Polypropylene

Mass per unit area: 250 g/m^2 (ISO: 9864)

Thickness in mm: 2.2 mm (ISO: 9868)

Tensile strength: 19 kN/m (ISO: 10319)

Geotextile shall be with UV treatment suitable for temperature range from 0-50^0 C

7.4.5 Pipe

The pipes used for peripheral finger drains and side finger drains should be 200mm nominal diameter PVC pipe of thickness 15.6mm, Class 4, 0.8 MPa.

Following are the design criteria for size of hole/slot in the pipe:

$D_{85}F$/Slot Width > 1.2 to 1.4

$D_{85}F$/Hole Diameter > 1.2 to 1.4

No. of slots/holes = three; one at the crown of the pipe (vertically upward) and other two at 60^0 from the center of the pipe (on left and right sides)

Spacing of slot/hole = 150 mm

Filter around the pipe should not contain to size larger than 75mm and material finer than 75 micron should not be more than 5%

8. ENGINEERING ANALYSIS

8.1 Slope Stability Analysis

Slope stability analyses were performed for the most critical sections of the proposed Peripheral Dyke Raisings. For this purpose three sections (one section B-B near river side from NGL beyond the existing D/S toe, another section E-E where starter dyke and 1st raising do not exist; the third one i.e. F-F where earlier subsidence occurred and retrofitting was done in the year 2011) have been considered for stability analysis.

8.2 Computer Programme

Slope stability analyses were performed using the modified version of the computer program STABL WV 2007, the latest version of STABL program developed by Purdue University for the Indiana State Highway Commission in 1986 (Carpenter 1986; Van Allen, 1995).

The STABL WV 2007 programs are written in FORTRAN, and calculate the factor of safety against slope failure by a two-dimensional limiting equilibrium method. The calculation of the factor of safety against slope instability is performed using the Simplified Bishop method of slices, which is applicable to circular shaped failure surfaces, the Simplified Janbu's method of slices, which is applicable to failure surfaces of a general shape, or Spencer's method of slices, which is applicable to surfaces having a circular or general shape.

It features unique techniques for random generation of potential failure surfaces for subsequent determination of the more critical failure surfaces and their corresponding factors of safety. Circular, irregular and sliding block surfaces may be generated and analyzed using either a random search technique or specific input of the coordinates of a given potential failure surface.

The programs are capable of handling heterogeneous soil systems, anisotropic soil strength parameters, excess pore water pressure, static ground water and surface water, pseudo-static earthquake loading, surcharge and tie back loading. The program also provides plotted output which can be used to check the correctness of problem input data and to locate the critical failure circles.

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In the present analysis, the modified version of STABL known as G-STABL has been used. The G-STABL accepts the data files of STABL and has the facility of producing an onscreen graphic output which can also be sent to a printer.

8.3 Factors of Safety

In the stability analysis of slopes, many design factors cannot be determined with certainty. Therefore, a degree of risk should be assessed in an adopted design. The factor of safety fulfills this requirement. The factor should take into account not only the uncertainties in design parameters but also the consequences of failure. Where the consequences of failure are less severe, a greater risk of failure or a lower factor of safety may be acceptable.

The potential seriousness of failure is related to many factors other than the size of project. A low dam located above or close to inhabited buildings can pose a greater danger than a high dam in a remote location. Often, the most potentially dangerous types of failure involve soils that undergo a sudden release of energy without much warning. This is true for soils subjected to liquefaction and that have a low ratio between the residual and peak strength.

Table 3 shows the factors of safety suggested by various sources for solid waste operations (D'Appolonia Consulting Engineers, 1975; Federal Register, 1977; Mine Branch, Canada, 1972; National Coal Board, 1970). All of these stipulations are based on the assumptions that the most critical failure surface is used in the analysis, that the strength parameters are reasonably representative of the actual case, and that sufficient construction control is ensured.

For each slope composed of intact homogeneous soils, when the strength parameters have been chosen on the basis of good laboratory tests and a careful estimate of pore pressure has been made, a safety factor of at least 1.5 is commonly employed (Lambe and Whitman, 1969) for static loading conditions. For seismic analysis, the recommended values vary between 1.0 and 1.2. Since the Indian Standard has not specified any recommendation related to the factor of safety of ash disposal facilities, we consider the recommendations of other international organizations such as U.S.A., U.K. and Canada. Based on their recommendation, it is recommended that the following F.S. should be considered for this site:

F.S. (static) 1.5	Long Term Performance
F.S. (static) 1.3	Short Term Performance
F.S. (dynamic) 1.2	Long Term Performance
F.S. (dynamic) 1.0	Short Term Performance.

Table 3: Factor of Safety Suggested for Solid Waste Disposal

United States (Federal Register, 1977)	Minimum safety factor		
1. End of construction	1.3		
2. Partial pool with steady seepage saturation	1.5		
3. Steady seepage from spillway or decant crest	1.5		
4. Earthquake (Case 2 and 3 with seismic loading)	1.0		
United States (D' Appolina Consulting Engineers, Inc., 1975)	Suggested minimum factor of safety with hazard potential		
	High	Mode-rate	Low
1. Design based on shear strength parameters measured in the laboratory	1.5	1.4	1.3
2. Design that consider maximum seismic acceleration expected at the site	1.2	1.1	1.0
Britain (National Coal Board, 1970)	Factor of safety 1* 2**		
1. For slip surfaces along which the peak shear stress is used	1.5	1.25	
2. For slip surfaces passing through a foundation stratum which is at its residual shear strength (slip circles wholly within the bank should satisfy (1))	1.35	1.15	
3. For slip surfaces passing along a deep vertical subsidence crack where no shear strength is mobilized and which is filled with water (slip surface wholly within intact zones of bank and foundations should satisfy (1))	1.35	1.15	
4. For slip surfaces where both (2) and (3) apply	1.2	1.1	
Canada (Mines Branch, Canada, 1972)	Factor of safety 1* 2**		
Design is based on peak shear strength parameter	1.5	1.3	
Design is based on residual shear strength parameter	1.3	1.2	
Analyses that include the predicted 100-year return period accelerations applied to the potential failure mass	1.2	1.1	
For horizontal sliding on base of dyke in seismic areas assuming shear strength of fine refuse in impoundment reduced to zero	1.3	1.3	

* Where there is a risk of danger to persons or property

** Where no risk of danger to persons or property is anticipated

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8.4 Geotechnical Design Parameters

Four basic soil and ash zones exist within the proposed ash disposal facility. These zones are:

(i) Foundation soil

(ii) Existing compacted Soil Dyke

(iii) Compacted ash in existing/proposed embankment

(iv) Settled Ash slurry in the pond

For stability analysis, strength and other geotechnical properties of the material should be established based on field and laboratory tests. In the past several field and laboratory investigations have been carried out at this site for designing of Lagoon 1 buttressing. Those test results have been reported by the consultant in the previous report also in book entitled "Geo-Environmental Design Practice in Fly ash Disposal & Utilization" (Dayal and Sinha 2005) ash properties of Indian ashes are reported based on ash and bottom ash testing of numerous sites. From these test results the assumed geotechnical properties of all the material used in the stability analyses are summarized in Table 4.

For the simplicity of analysis it is assumed that the soil cover possesses the same properties as that of compacted ash. In fact, well compacted cover soil containing clayey sand/bottom ashy silt which is available locally will have higher shear strength values compared to the one assumed for compacted ash and, therefore, this assumption is conservative. In comparison to ash, the cover material will generally have higher density. However, this would have negligible effect on the factor of safety obtained from stability analyses as both resisting moment and actuating moment will increase approximately in the same proportion. However, if higher shear strength value is assumed for the cover material, the factor of safety of the slope will be slightly higher than those reported herein. However, it is not warranted to include such minor details in the slope stability analysis.

Table 4: Geotechnical Properties of Soil and Ash Materials

Sl. No.	Material Type	Total unit weight (kg/m^3)	Saturated unit weight (kg/m^3)	Cohesion (Kg/m^2)	Angle of internal friction (Ø)
1.	Foundation Soil	1700	1800	10	34
2.	Existing soil Embankment Soil/ash Embankment	1750	1832	10	33
3.	Proposed / Existing Compacted Ash Embankment	1500	1600	5	31
4.	Settled Ash	1400	1500	0	29

If the soil cover and ash embankment are raised, compacted and constructed simultaneously, a good bond is assured between both sections without any additional precautions. However, if the soil cover is constructed after the construction of the ash embankment, a good bond should be developed to prevent slippage between the cover material and ash embankment as per the procedure outlined in guideline specifications section given in this report. If the soil and ash interface is properly constructed, the F.S. along the plane of intersection of ash and cover material should be higher than those reported for the slope.

8.5 Piezometric Surface

The piezometric level used in the analyses of the raising of the embankment are conservatively assumed and indicated on the cited figures based on the proposed location of the internal drains in the proposed raising portion and the elevation of the maximum projected impoundment surface for the final stage of operation.

In the static and seismic analyses of the critical sections, the impoundment surface level was assumed to be at the maximum pool resulting from storage of the design storm and operating slurry water which is estimated to be 1m below the maximum crest elevation of settled ash. It is to be noted that the maximum permissible elevation of the ash plus slurry water should always be at least 1.0 m below the crest elevation.

8.6 Earthquake Loading

The seismic stability analysis is performed for pseudostatic condition assuming suitable earthquake loading. The recent recommendations published by the Indian Standard (IS: 1893: 1984) suggest that Kanhia lies in earthquake zones III. As per the IS code the seismic acceleration of 0.1g acting in a horizontal direction should be used for zone III (Refer Table 7.1, Dayal & Sinha 2005). Therefore, the strengthening of the existing Ash dike and subsequent raising of the containment dike has been designed to withstand the earthquake force applicable for zone III for the condition of long term factor of Safety. In the present design, the ash embankment has been designed to provide a minimum long term factor of safety (FS) of 1.5 for static condition and F.S. of 1.2 for earthquake loading associated with the zone III.

5.7 Results

The slope stability analyses have been performed for the most critical Dyke cross-sections buttressing and raising up to level of 125m. The slope stability analysis results for the most critical sections for static and seismic cases are shown in Appendix - B. Slope stability analysis of ten most critical failure surfaces are summarized in those figures. The complete computer input and output data and the complete searches of the failure surfaces could not be attached for the sake of space and brevity. 50000 slip surfaces have been generated for each analysis.

The minimum F.S. obtained for most critical failure surfaces in various stages of construction are shown in the Table 5.

Table 5: Summary of Factor of safety obtained

Sl. No.	Critical Sections	Up to Elevations	Factor of Safety (rounded off to one decimal point)	
			Static Analysis	Seismic Analysis
1	A-A	125 m	1.92	1.38
2	B-B	125 m	1.79	1.25
3	C-C	125 m	2.09	1.46
4	D-D	125 m	2.19	1.53
5	E-E	125 m	2.38	1.67
6	F-F	125m	2.26	1.57
7	G-G	125 m	1.84	1.28

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This is to be noted that these values are for the typical critical slope sections and for the condition that may exist for long term performance. In section B-B buttressing starts from the NGL beyond the existing toe of the starter dyke where total height of the dyke after buttressing is 42m. Section E-E is chosen where buttressing starts from the top of the starter dyke and where the total height up to the top of 2nd raising is about 21m (Starter dyke, 1st raising do not exist). In section F-F buttressing starts from the NGL beyond the existing toe of the starter dyke where total height of the dyke up to crest of 2nd raising will be about 29m because in the year 2011 after subsidence of the dyke retrofitting was done. Most of the time during operation of the facility the minimum F. S. are well over 1.5 and 1.2 for static and dynamic loading conditions. Based on stability analyses the proposed cross sections of the Dyke for strengthening and raising are safe. Because of greater length of the slope in the deepest section such as A-A, the slope is stable since most part of the slope rests over stable original ground.

The piezometric levels assumed in the analyses are based on the locations of internal drainage system and neglecting the ash deposition on upstream slope. It is believed that the piezometric level will be much lower than the one assumed for analyses because of the formation of impervious ash seal on the upstream slope due to ash slurry deposition. However, theoretically it is difficult to estimate the piezometric level for such condition and the accepted practice is to monitor the piezometric level. For this reason, an extensive instrumentation programme is implemented which includes the installation of piezometers at critical locations. Recording of the water level in the piezometers during the operation of facility should be continuous and periodically it should be reviewed by an expert geotechnical engineer. If the piezometric level exceeds the one assumed in the stability analysis, as shown in Figures (Appendix – B) further investigations may be required to check the safety of the facility.

9.0 CONCLUDING REMARKS

The report presented herein includes the design of Peripheral Ash Filling up to ash dyke El. 120m and Raising of Phase up to El 125m for disposal of ash slurry produced from the TSPTS Power Plant. The enclosed figures, detailing, plans, and cross-sections have been designed based on actual site conditions, geotechnical properties of pond ash and the design drawings of the existing ash ponds supplied by TSTPS. The report also includes specifications for main construction materials.

Respectfully submitted.

Sincerely yours,

Dr. C R Patra
Professor
NIT Rourkela

Dr. Umesh Dayal
Professor (Retd.)
IIT Kanpur

(Consultants)

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Annexure- B

GOVERNMENT OF INDIA/ भारत सरकार
MINISTRY OF RAILWAYS/ रेल मंत्रालय
(RAILWAY BOARD/ रेलवे बोर्ड)

No.2013/Track-II/22/2/2 New Delhi,dt. 17.10.18

Principal Chief Engineer,
All Zonal Railways.

Chief Administrative Officer,
All Zonal Railways.

Sub:-Production of wider and heavier PSC sleepers from 2019-20.
Ref:-(i)Railway Board's letter of even no. dtd. 09.07.18.
(ii) PCE/CR's letter no. W.188.C-348/Wider sleeper dtd. 09.08.2018.

1. Approval of Board (ME &FC) was communicated to all Zonal Railways vide letter no. 2013/TK-II/22/2/2Pt.II dtd. 09.07.18 regarding use of wider & heavier sleeper RT-8527 from Financial Year 2019-20 onward.

2. However, certain railways have represented that many of the sleeper renewal works are getting sanctioned on small track lengths on condition basis or on replacement from 52 kg PSC to 60 kg PSC along with TRR (mostly on service life of rails criteria) and it may not be prudent to sandwich small length of wider sleeper patch between normal sleepers from maintenance consideration.

3. The issues raised above have been considered and Board (ME) has approved that Zonal Railways may procure ordinary line sleepers (RT-2496) in following cases after conclusion of ongoing contract CS-169.

   (i) For track renewal of sanctioned patches, which are less than 2 km length in a continuous stretch.
   (ii) TSR required for track patches which have 52 kg rail.
   (iii) For keeping imprest of sleepers for maintenance of track and accident restoration work.

4. The decision to use RT-2496 sleepers at patches less than 2 km length as per 3(i) above should be taken only after reviewing the planning for sleeper renewal in adjoining patches. If the adjoining patches are likely to be renewed within say 5 years, it would be advisable to use RT-8527 sleepers only except for very short patches of less than say 500 m length.

5. The decision on use of RT-2496 sleeper in TSR works in 52 kg stretches where rails are not due for renewal, as per 3(ii) above, should be taken, after carefully reviewing the

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perspective planning for TRR. If TRR is to be carried out within say 5 years, it would be advisable to carry out CTR in such stretches with RT-8527 sleepers and 60 kg rails. The released second hand 52 kg rails can be used for casual renewal or secondary renewals. Moreover, at many stretches, CTR with 60 kg is being sanctioned as 52 kg rails have become due for renewal, where good second class 52 kg sleepers will be released. Railway should also consider the feasibility of using these second class 52 kg sleepers for carrying out TSR in 52 kg stretches while deciding the quantity of new sleepers to RT-2496 to be procured.

6. The decision regarding 3 (i) & (ii) above in respect of individual stretches should be taken with the approval of CTE duly taking into account 4 & 5 above. The use of RT-2496 sleepers for maintenance/accident restoration at individual stretches as per 3(iii) above should be carried out with the approval of Sr. DEN(C).

17/x/18

(Vinod K. Tripathi)
Director Track (Mod.)
Railway Board
Tel/Fax-23389161

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Annexure-C

MINUTES OF THE 4th MEETING OF THE RE-CONSTITUTED EXPERT APPRAISAL COMMITTEE (EAC) ON ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF THERMAL POWER PROJECTS

The 4thMeeting of the re-constituted EAC (Thermal Power) was held on 16thMarch, 2017in the Ministry of Environment, Forest& Climate Change at Teesta Meeting Hall, Vayu Wing, First Floor, Indira Paryavaran Bhawan, Jorbagh Road, New Delhi under the Chairmanship of Dr.Navin Chandra. The following members were present:

1.	Dr.Navin Chandra	-	Chairman
2.	Dr. Narmada Prasad Shukla	-	Member
3.	Shri N. Mohan Karnat	-	Member
4.	Dr.Sharachchandra Lele	-	Member
5.	Shri P. D. Siwal	-	Member (Representative of CEA)
6.	Dr. R. K. Giri	-	Member (Representative of IMD)
7.	Dr. S. Kerketta	-	Member Secretary

Dr. Rajesh P.Gunaga, Dr.S. K. Paliwal (Representative of CPCB) and Professor D. C. Panigrahi (Representative of ISM Dhanbad) could not be present.

Item No.4.0:CONFIRMATION OF THE MINUTES OF THE 3rdEAC MEETING.

The Minutes of the 3rdEAC (Thermal Power) Meeting held on 14th February, 2017 were confirmed.

Item No. 4: CONSIDERATION OF PROJECTS

4.1 Expansion of 2x363.3 MW Gas based Power Project at Palatana, Tehsil Kakraban, Dist. Gomati, Tripura by M/s ONGC Tripura Power Company Limited- reg. consideration for ToR.

(4.1.1) PP submitted online application for grant of ToR on 13.2.2017. Project Proponent along with Environment Consultant M/s ERM India Pvt. Ltd. made presentation and inter-alia submitted the following:

i. Proposed expansion of Combined Cycle Gas Turbine Power Project with a capacity of 2x363.3 MW (Unit-3&4) will be set up at Village Palatana, Tehsil Kakraban, Tripura in the premises of existing power plant 2x363.3 MW (Unit-1&2) which is under operation.

ii. Additional land requirement of approximately 33 acres is required for the proposed expansion project. The total land of 197.15 acres is available at the project site which is inclusive of 33 acres. Thus, no additional land acquisition is involved for the proposed project.Out of 197.15 acres, 193.66 acres is forest land for which diversion approval has already been obtained.

iii. The project site is surrounded by Reserved Forests. Trishna Wildlife Sanctuary is at 20 km South and Sepahijhala Wildlife Sanctuary is at 18 km from the proposed site. The site falls in Seismic Zone V. Design of the proposed structures shall be earthquake resistant.

iv. Water requirement for the proposed project is 18,650 m^3/day which will be sourced from River Ghumti located at 2 km from project site. Government of Tripura allocated for drawl of 125 MLD vide letter dated 12.5.2005.

activities.Surface and ground water quality along with existing piezometric wells shall be monitored quarterly and the reports shall be submitted to the Ministry annually.

vi. Current state of flyash utilisation shall be incompliance with Flyash Notification and its amendments issued time to time.

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4.7 Disposal of fly ash generated from Talcher Super Thermal Power Station (Stage-I:2x500 MW & Stage-II: 4x500 MW) into abandoned mine voids of Jagannath OPC of Mahanadi Coalfields Limited in Talcher, Dist. Angul, Odisha by M/s NTPC Limited- reg. re-consideration for permission.

(4.7.1) Project Proponent (PP) submitted the online application on 2.1.2017. The proposal for ash filling in Jagannath Opencast Mines generated from Talcher Super Thermal Power Station. M/s Bhushan Steel Ltd. has already been disposing flyash in the same mines for last three years. The proposal was earlier considered by the EAC on 29.4.2015 and deferred as the studies conducted by M/s Bhushan Steel Ltd. regarding leachate tests, radio tracer studies were still under completion. Also, the existing ash pond of M/s NTPC could accommodate flyash for four years at that time. Accordingly, EAC suggested to submit the scientific and engineering plan for backfilling of the mines after consulting National and International Experts for exploring various geo-technical and engineering solutions. Simultaneously, alternate avenues for flyash utilisation shall be explored by the PP.

(4.7.2) PP along with NEERI and CMPDI made presentation inter-alia submitted the following:

i. NTPC Talcher Super Thermal Power Station (TSTPS), Kaniha, Dist. Angul, Odisha has a total power generation installed capacity of 3010 MW. Coal to TSTPS is being supplied by Talcher coalfields (Lingaraj block) of Mahanadi Coalfields Ltd and source of water is Samal Barrage Reservoir on river Brahmani. Coal is transported to NTPC-TSTPS from Lingaraj coal mines of MCL through a 39 km MGR railway transportation system. The station generates approximately 6.5 MTPA of total ash (flyash and bottom ash) and could utilised only 38-43%.

ii. Unutilised ash is being disposed into tow ash disposal areas (Stage-I: 750 acres and Stage-II: 840 acres) located at about 7 km N-W of the plant. Stage-I ash pond is nearly full in capacity and Stage-II ash pond is critical capacity and will last up to 2020.

iii. MCL has allotted Quarry no.8 of Jagannath OCP to NTPC for backfilling ash from TSTPS.

iv. NTPC conducted Hydro-geological studies, characterisation and leachate studies conducted by NEERI.

v. As suggested by EAC, market survey to assess ash utilisation potential for various uses in the vicinity of power plant has been conducted. Analysis of scientific and engineering alternatives for disposal of ash from Talcher STPP has been conducted by CMPDI.

vi. Transportation modes of flyash from the power plant to Jagannath mines have been analysed. Slurry pumping through pipeline is recommended for the distance of approximately 20 km.

vii. Ground water levels have been monitored. The results show that during pre-monsoon season, maximum depth of groundwater is observed at 12.95 metres below ground level (bgl) at Village Ekdal to minimum depth at 2.10 mbgl at village Jagnnathpur. During post monsoon season, maximum depth of groundwater is found at 5.98 m bgl and minimum depth found at 1.21 m bgl at village Deulbara.

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(4.7.3)Committee noted that the proposal of NTPC for flyash filling in Quarry no.8 of Jagannath Opencast mine is adjacent to the Quarry no.4 of Jaggannath opencast mine in which M/s Bhushan Steel Ltd has already been disposing flyash for the last three years. The studies conducted by NEERI are conclusive and recommend for flyash disposal in these quarries.

(4.7.4) Committee after detailed deliberations, **recommended for grant of temporary permission for a period of five years** for disposal of flyash subject to the following conditions:

i. A pilot project shall be explored for implementation for Cenosphere extraction from flyash and manufacturing of by-products in consultation with organizations like CSIR, ISM (IIT) Dhanbad.

ii. As recommended by NEERI, Ash characterisation, hydro-geological studies, leachability of trace metals, monitoring of trace elements in the supernatant, pH of the water and the piezometers on a quarterly basis and reports shall be submitted to the Ministry and it's regional office annually.

iii. Radio tracer studies shall be continued once in six months and the findings of the study shall be submitted to the Ministry and its Regional office annually.

iv. Bioaccumulation and bio-magnification tests shall be conducted on surrounding flora and fauna (tree leaves, vegetation, crop yields and cattle population etc) during pre-monsoon and post monsoon to find out any trace metals escaped through groundwater or runoff.

v. Surface water and runoff from the mine void/flyash shall not be let out into the nearby stream/drainage and shall be reused for the ash filling and power plant activities. Surface and ground water quality along with existing piezometric wells shall be monitored quarterly and the reports shall be submitted to the Ministry annually.

vi. Current state of flyash utilisation shall be incompliance with Flyash Notification and its amendments issued time to time.

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4.8 ANY OTHER ITEM WITH THE PERMISSION OF THE CHAIR.

(4.8.1) 2x800 MW Coal based Lara Super Thermal Power Project at villages Armuda, Chhapora, Bodajharia, Devalpura, Mahloi, Riyapalli, Lara, Jhilgitar and Kandagarh in TalukPussore, in District Raigarh, in Chhattisgarh by M/s NTPC Ltd. – reg amendment of EC.

(4.8.1.1) Project Proponent (PP) submitted online application on 16.2.2017 for transportation of 7777 MT/day coal through road till November, 2019. The proposal was earlier considered in 2nd Re-constituted EAC meeting held on 20.1.2017 and was rejected as 15,554 MT of coal per day will be transported by 2074 truck trips per day through road network of 115 km. The present proposal is for one unit and the quantity of coal to be transported will be reduced to half.

(4.8.1.2) Project Proponent (PP) along with M/s Min Mec Consultancy Pvt. Ltd made the presentation and, *inter-alia* submitted the following:

i. As per the Hon'ble Supreme Court's order, the coal block was de-allocated on 24.9.2014 and later it was re-allocated on 8.9.2015 which has delayed its production plan of Talaipalli Coal Mine. Coal production is expected to commence by November, 2019.

ii. As the Unit-1:1x800 MW is expected to be commissioned by April, 2017 and the Talaipalli Coal block is expected to start its production by November, 2019, Coal India Limited (CIL) vide their letter dated 2.6.2016, granted Bridge Coal Linkage for the said project and the coal will be sourced from two places i.e.

Annexure D

STATE POLLUTION CONTROL BOARD, ODISHA

[DEPARTMENT OF FOREST & ENVIRONMENT, GOVERNMENT OF ODISHA]
A/118, Nilakantha Nagar, Unit-VIII, Bhubaneswar-751012
Phone-0674-2564033 / EPABX : 2561909/2562847
E-mail: paribesh1@ospcboard.org/ Website: www.ospcboard.org

No. 3109 / IND-I-CON-105 Dt. 27.03.2019

CONSENT ORDER

Sub : **Consent for discharge of sewage and trade effluent under section 25/26 of Water(P&CP) Act, 1974 and for existing/new operation of the plant under section 21 of Air(P&CP) Act, 1981.**

Ref : Your online application **ID No. 2344847 , Dt. 30.11.2018**

Consent to operate is hereby granted under section 25/26 of Water (Prevention & Control of Pollution) Act, 1974 and under section 21 of Air (Prevention & Control of Pollution) Act, 1981 and rules framed thereunder to

Name of the Industry **M/s. Talcher Super Thermal Power Station, NTPC Limited**

Name of the Occupier & Designation **Sri. SANTOSH JAMES,Chief General manager**

Address- **At-Deepsikha , Dist-Angul-759 147**

This consent order is valid for the period from **01.04.2019 to 30.09.2019**

This consent order is valid for the product quantity, specified outlets, discharge quantity and quality, specified chimney/stack, emission quantity and quality of emissions as specified below. This consent is granted subject to the general and special conditions stipulated therein.

A. Details of Products Manufactured

Sl.No.	Product	Quantity
01.	Electricity (Unit-I&II of Stage-I, Unit-III,IV,V,VI of Stage - II)	2x500 MW 4x500 MW

B. Discharge permitted through the following outlet subject to the standard

Outlet No.	Description of outlet	Point of discharge	Quantity of discharge KLD or KL/hr	Pre-scribed Standard	
01.	Industrial drain effluent	To be recycled completely			
02.	Seepage and overflow effluent of ash pond	To be recycled completely			
03 .	Domestic water	Used for horticulture and plantation after treatment in STP		pH	6.5-9.0
				BOD	less than 30mg/l
				TSS	less than 100mg/l
				Fecal Coliform (FC) (most probable number per 100 millilitre, MPN/100ml)	less than 1000

C. Emission permitted through the following stack subject to the prescribed standard

Chimney Stack No.	Description of Stack	Stack height (m)	Quantity of emission (m^3/sec)	Prescribed Standard (mg/Nm^3)			
				PM	SO_2	NO_x	Hg
1	Stack attached to ESPs of Unit-1 & 2	275	583	100	200	600	0.03
2	Stack attached to ESPs of Unit- 3 & 4	275	574	50	200	300	0.03
3	Stack attached to ESPs of Unit- 5 & 6	275	574	50	200	300	0.03

D. Disposal of solid waste permitted in the following manner

Sl.No.	Type of Solid waste	Quantity generated (TPD)	Quantity to be reused on site(TPD)	Quantity to be reused off site(TPD)	Quantity disposed off (TPD)	Description of disposal site.
1.	Fly Ash	19,600	--	--	19,600	Utilization as per fly ash notification. Rest to be disposed through lean slurry to ash pond.

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E. GENERAL CONDITIONS FOR ALL UNITS

1. The consent is given by the Board in consideration of the particulars given in the application. Any change or alternation or deviation made in actual practice from the particulars furnished in the application will also be the ground liable for review/variation/revocation of the consent order under section 27 of the Act of Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act, 1981 and to make such variations as deemed fit for the purpose of the Acts.
2. The industry would immediately submit revised application for consent to operate to this Board in the event of any change in the quantity and quality of raw material / and products / manufacturing process or quantity /quality of the effluent rate of emission / air pollution control equipment / system etc.
3. The applicant shall not change or alter either the quality or quantity or the rate of discharge or temperature or the route of discharge without the previous written permission of the Board.
4. The application shall comply with and carry out the directives/orders issued by the Board in this consent order and at all subsequent times without any negligence on his part. . In case of non-compliance of any order/directives issued at any time and/or violation of the terms and conditions of this consent order, the applicant shall be liable for legal action as per the provisions of the Law/Act.
5. The applicant shall make an application for grant of fresh consent at least 90 days before the date of expiry of this consent order.
6. The issuance of this consent does not convey any property right in either real or personal property or any exclusive privileges nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Central, State laws or regulation.
7. This consent does not authorize or approve the construction of any physical structure or facilities or the undertaking of any work in any natural water course.
8. The applicant shall display this consent granted to him in a prominent place for perusal of the public and inspecting officers of this Board.
9. An inspection book shall be opened and made available to Board's Officers during their visit to the factory.
10. The applicant shall furnish to the visiting officer of the Board any information regarding the construction, installation or operation of the plant or of effluent treatment system / air pollution control system / stack monitoring system any other particulars as may be pertinent to preventing and controlling pollution of Water / Air.
11. Meters must be affixed at the entrance of the water supply connection so that such meters are easily accessible for inspection and maintenance and for other purposes of the Act provided that the place where it is affixed shall in no case be at a point before which water has been taped by the consumer for utilization for any purposes whatsoever.
12. Separate meters with necessary pipe-line for assessing the quantity of water used for each of the purposes mentioned below:
    a) Industrial cooling, spraying in mine pits or boiler feed,
    b) Domestic purpose
    c) Process
13. The applicant shall display suitable caution board at the lace where the effluent is entering into any water-body or any other place to be indicated by the Board, indicating therein that the area into which the effluents are being discharged is not fit for the domestic use/bathing.
14. Storm water shall not be allowed to mix with the trade and/or domestic effluent on the upstream of the terminal manholes where the flow measuring devices will be installed.
15. The applicant shall maintain good house-keeping both within the factory and the premises. All pipes, valves, sewers and drains shall be leak-proof. Floor washing shall be admitted into the effluent collection system only and shall not be allowed to find their way in storm drains or open areas.
16. The applicant shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems install or used by him to achieve with the term(s) and conditions of the consent.
17. Care should be taken to keep the anaerobic lagoons, if any, biologically active and not utilized as mere stagnation ponds. The anaerobic lagoons should be fed with the required nutrients for effective digestion. Lagoons should be constructed with sides and bottom made impervious.
18. The utilization of treated effluent on factory's own land, if any, should be completed and there should be no possibility of the effluent gaining access into any drainage channel or other water courses either directly or by overflow.
19. The effluent disposal on land, if any, should be done without creating any nuisance to the surroundings or inundation of the lands at any time.
20. If at any time the disposal of treated effluent on land becomes incomplete or unsatisfactory or create any problem or becomes a matter of dispute, the industry must adopt alternate satisfactory treatment and disposal measures.
21. The sludge generated from treatment units shall be dried in sludge drying beds and the drained liquid shall be taken to equalization tank of treatment plant.
22. The effluent treatment units and disposal measures shall become operative at the time of commencement of production.
23. The applicant shall provide port holes for sampling the emissions and access platform for carrying out stack sampling and provide electrical outlet points and other arrangements for chimneys/stacks and other sources of emissions so as to collect samples of emission by the Board or the applicant at any time in accordance with the provision of the Act or Rules made therein.
24. The applicant shall provide all facilities and render required assistance to the Board staff for collection of samples / stack monitoring / inspection.
25. The applicant shall not change or alter either the quality or quantity or rate of emission or install, replace or alter the air pollution control equipment or change the raw material or manufacturing process resulting in any change in quality and/or quantity of emissions, without the previous written permission of the Board.
26. No control equipments or chimney shall be altered or replaced or as the case may be erected or re-erected except with

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the previous approval of the Board.

27. The liquid effluent arising out of the operation of the air pollution control equipment shall be treated in the manner to the meet the prescribed standards by the Board in accordance with the provisions of Water (Prevention and Control of Pollution) Act, 1974 (as amended).

28. The stack and ambient monitoring system installed by the applicant shall be opened for inspection to this Board at any time.

29. There shall not be any fugitive or episodal discharge from the premises.

30. In case of such episodal discharge/emissions the industry shall take immediate action to bring down the emission within the limits prescribed by the Board in conditions/stop the operation of the plant. Report of such accidental discharge /emission shall be brought to the notice of the Board within 24 hours of occurrence.

31. The applicant shall keep the premises of the industrial plant and air pollution control equipments clean and make all hoods, pipes, valves, stacks/chimneys leak proof. The air pollution control equipments, location, inspection chambers, sampling port holes shall be made easily accessible at all times.

32. Any upset condition in any of the plant/plants of the factory which is likely to result in increased effluent discharge/emission of air pollutants and / or result in violation of the standards mentioned above shall be reported to the Headquarters and Regional Office of the Board by fax / speed post within 24 hours of its occurence.

33. The industry has to ensure that minimum three varieties of indigenous species of trees are planted at the density of not less than 1000 trees per acre. The trees may be planted along boundaries of the industries or industrial premises. This plantation is stipulated over and above the bulk plantation of trees in that area.

34. The solid waste such as sweeping, wastage packages, empty containers residues, sludge including that from air pollution control equipments collected within the premises of the industrial plants shall be disposed off scientifically to the satisfaction of the Board, so as no to cause fugitive emission, dust problems through leaching etc., of any kind.

35. All solid wastes arising in the premises shall be properly classified and disposed off to the satisfaction of the Board by :
    i) Land fill in case of inert material, care being taken to ensure that the material does not give rise to leachate which may percolate into ground water or carried away with storm run-off.
    ii) Controlled incineration, wherever possible in case of combustible organic material.
    iii) Composting, in case of bio-degradable material.

36. Any toxic material shall be detoxicated if possible, otherwise be sealed in steel drums and buried in protected areas after obtaining approval of this Board in writing. The detoxication or sealing and burying shall be carried out in the presence of Board's authorized persons only. Letter of authorization shall be obtained for handling and disposal of hazardous wastes.

37. If due to any technological improvement or otherwise this Board is of opinion that all or any of the conditions referred to above requires variation (including the change of any control equipment either in whole or in part) this Board shall after giving the applicant an opportunity of being heard, vary all or any of such condition and thereupon the applicant shall be bound to comply with the conditions so varied.

38. The applicant, his/heirs/legal representatives or assignees shall have no claim whatsoever to the condition or renewal of this consent after the expiry period of this consent.

39. The Board reserves the right to review, impose additional conditions or condition, revoke change or alter the terms and conditions of this consent.

40 Notwithstanding anything contained in this conditional letter of consent, the Board hereby reserves to it the right and power under section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 to review any and/or all the conditions imposed herein above and to make such variations as deemed fit for the purpose of the Act by the Board.

41. The conditions imposed as above shall continue to be in force until revoked under section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 and section 21 A of Air (Prevention & Control of Pollution) Act, 1981.

42. The industry shall comply to all the conditions stipulated under Charter on Corporate Responsibility for Environmental Protection (CREP) guidelines in a time bound manner as envisaged there in. (if applicable)

43. The industry shall comply to the conditions stipulated in CTE order issued by ODISHA State Pollution Control Board .

44. The industry shall abide by E(P) Act, 1986 and Rules framed there-under

45. In case the consent fee is revised upward during this period, the industry shall pay the differential fees to the Board (for the remaining years) to keep the consent order in force. If they fail to pay the adequate amount within the period stipulated by the Board the consent order will be revoked without prior notice.

46. The Board reserves the right to revoke/refuse consent to operate at any time during period for which consent is granted in case any violation is observed and to modify/ stipulate additional conditions as deemed appropriate.

GENERAL CONDITIONS FOR UNITS WITH INVESTMENT OF MORE THAN Rs 50 CRORES, AND 17 CATEGORIES OF HIGHLY POLLUTING INDUSTRIES (RED A).

1. The applicant shall analyse the effluent / emissions and Ambient Air Quality every month through approved laboratory for the parameters indicated in TABLE- 'B', 'C' & Part -'B' as mentioned in this order and shall furnish the report thereof to the Board on monthly basis.

2. The following information shall be forwarded to the Member Secretary on or before 10th of every month.

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a) Performance / progress of the treatment plant.

b) Monthly statement of daily discharge of domestic and/or trade effluent.

3. Non-compliance with effluent limitations

a) If for any reason the applicant does not comply with or is unable to comply with any effluent limitations specified in this consent, the applicant shall immediately notify the consent issuing authority by telephone and provide the consent issuing authority with the following information in writing within 5 days of such notification.

i) Causes of non-compliance

ii) A description of the non-compliance discharge including its impact on the receiving waters.

iii) Anticipated time of continuance of non-compliance if expected to continue or if such condition has been corrected the duration or period of non-compliance.

iv) Steps taken by the applicant to reduce and eliminate the non-complying discharge and

v) Steps to be taken by the applicant too prevent the condition of non-compliance.

b) The applicant shall take all reasonable steps to minimize any adverse impact to natural waters resulting from non-compliance with any effluent limitation specified in this consent including such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge.

c) Nothing in this consent shall be construed to relieve the applicant from civil or criminal penalties for non-compliance whether or not such non-compliance is due to factors beyond his control, such as break-down, electric failure, accident or natural disaster.

4. Proper housekeeping shall be maintained inside the factory premises including process areas by a dedicated team.

5. The industry must constitute a team of responsible and technically qualified personnel who will ensure continuous operation of all pollution control devices round the clock (including night hours) and should be in a position to explain the status of operation of the pollution control measures to the inspecting officers of the Board at any point of time. The name of these persons with their contact telephone numbers shall be intimated to the concerned Regional Officer and Head Office of the Board and in case of any change in the team it shall be intimated to the Board immediately.

6. The industry shall engage dedicated qualified manpower to ensure continuous and effective operation of online stack / Ambient Air Quality / Effluent monitoring stations for maintenance of database, real time data transfer to SPCB server, data analysis and co-ordination with concerned personnel of process units for taking corrective measures in case of non-compliances and to respond to the instructions of SPCB in this matter.

F. SPECIAL CONDITIONS

F1. (Air Pollution Control)

1. Air pollution control measures installed at different potential dust generating points shall be operated continuously and effectively to control fugitive dust emission.
2. All the online continuous stack emission monitoring systems (CEMS) for measurement of particulate matter and gaseous pollutants shall be operated effectively and uninterruptedly and the online monitoring data so generated shall be transmitted to SPCB and CPCB server on a continuous basis.
3. All the online continuous ambient air quality monitoring stations (CAAQMS) shall be operated effectively and uninterruptedly and the online monitoring data so generated shall be transmitted to SPCB and CPCB server on a continuous basis.

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4. Steps shall be taken for regular monitoring of Mercury (Hg) in the stack of boilers and submit data to the Board.
5. The unit shall provide low NO_x burners to reduce NO_x emission to keep the level within the prescribed standard by MoEF & CC vide Notification dtd. 07.12.2015.
6. Steps shall be taken for installation of Flue Gas Desulpurisation (FGD) system in future if required to keep the SO2 level within 600mg/Nm^3 to confirm the MoEF & CC Notification dtd. 07.12.2015. This shall also include management and disposal of effluent / solid waste to be generated from FGD system.
7. The fly ash shall be pneumatically conveyed to a silo. The unit shall provide adequate dust extraction system to control dust emission in the transfer points for collection of ash to silo.
8. Appropriate measures like provision of water sprinkling or soil covering shall be made over the exposed dry surface of the ash ponds to prevent dust nuisance due to wind action. Dust suppression measures shall also be provided where construction activities are undertaken at ash pond area to prevent dust nuisance.
9. Adequate dust extraction system such as cyclone/bag filters and water spray system in dusty areas such as in coal handling and ash handling points, transfer areas and other vulnerable dusty areas shall be provided.
10. All raw material, product and waste material shall be transferred through covered vehicles without any spillage or leakages on the way, in case any accidental spillage on the road, waste shall be lifted by the industry and suitably disposed off and to be lifted by the industry and suitably disposed off in designated solid waste dumping area.
11. Ambient air quality shall conform to the National Ambient Air Quality standards as prescribed under E P Rules , 1986.
12. The unit shall submit fly ash utilization status to the Board annually and shall comply to the provisions of revised fly ash Notification No. SO.254(E),dt. 25.01.2016 of MOEF, Govt. of India.
13. Supply of fly ash to Brick Manufacturing units shall be done on free of cost. Further, transportation cost of fly ash within 100km radius of your plant shall be borne by you or a subsidy of Rs.150/- per ton of fly ash shall be provided to all the fly ash brick, tile, road construction or other fly ash based construction materials manufacturing units or for use in road making if utilizing your fly ash.
14. All Pollution control equipment may be provided with separate electricity meter and totalizer for continuous recording of power consumption. The amperage of the ID fan may also be recorded continuously. Non-functioning of Pollution control equipment should be recorded in the same logbook along with reasons for not running the Pollution Control Equipment.
15. Unloading of coal by trucks or wagons should be carried out with proper care avoiding dropping of the materials from height. It is advisable to moist the material by sprinkling water while unloading.
16. The industry shall maintain an Environmental Engineering Department in terms of

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manpower and infrastructure to cope with the increased workload and improved results for compliance to statutory norms. This shall be taken up on top priority. The head of the environment management cell should report to the unit Head.

17. Good housekeeping practices shall be followed to improve the work environment. All roads and shop floors shall be cleaned regularly.
18. Air compressor, DG set and turbine house should be acoustically designed and should be housed in appropriate acoustic enclosures so that the noise level outside it shall conform to the prescribed norms.
19. Care shall be taken so that ambient noise level shall conform to the standards prescribed under E(P) Act ,1986.
20. Periodical maintenance of all equipment, plant piping (including pollution control system) shall be carried out including calibration and testing.
21. A separate environmental management cell shall be formed with adequate laboratory facility and suitably qualified people to carry out various functions relating to environmental management effectively
22. The green belt of adequate width and density preferably with the local species along the periphery of the plant shall be raised so as to provide protection against particulates and noise. It must be ensured that at least 33% of the total land area shall be under permanent green cover. The proponent shall ensure the maintenance of green belt throughout the year and for all time to come. It is advised that, they may engaged professionals in this field for creation and maintenance of the green belt.
23. In case the consent fee is revised upward during this period, the industry shall pay the differential fees to the Board (for the remaining years) to keep the consent order in force. If they fail to pay the amount within the period stipulated by the Board the consent order will be revoked without prior notice.
24. The Board reserves the right to revoke/refuse consent to operate at any time during period for which consent is granted in case any violation is observed and to modify/ stipulate additional conditions as deemed appropriate.

F2 (Water Pollution Control)

1. Specific water consumption shall be limited within 3.5m^3/MWh as per MoEF & CC vide Notification dtd. 07.12.2015.
2. Under no circumstances there shall be any discharge of effluent to outside the factory premises.
3. The blow down of power plant shall meet the following standards before it is discharged to the common monitoring basin and shall be reused for ash handling, dust suppression and green belt.

Boiler blow down

Suspended solids	-	100.0 mg/l(Max)
Oil & Grease	-	20.0 mg/l(Max)
Copper (Total)	-	1.0 mg/l(Max)
Iron (Total)	-	1.0 mg/l(Max)

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Cooling Tower Blow down

Free available Chlorine	-	0.5 mg/l(Max)
Zinc	-	1.0 mg/l(Max)
Chromium (Total)	-	2.0 mg/l(Max)
Phosphate	-	5.0 mg/l(Max)

4. Concrete drains will be constructed along the pipeline corridor to prevent any discharge of ash slurry to any natural stream.
5. The pipeline corridor from the plant side up to the ash pond area shall be cleared regularly of vegetation growth.
6. The online continuous effluent quality monitoring system (EQMS) shall be operated effectively and uninterruptedly and the online monitoring data so generated shall be transmitted to SPCB and CPCB server on a continuous basis.
7. The Effluent Treatment Plant (ETP) shall be operated effectively and continuously through a dedicated in house team or through continued AMC so as to confirm to the prescribed norms.
8. The seepage from all the toe drains of entire ash pond area shall be collected in settling pond of adequate capacity and entire water shall be recirculated back to the plant for ash slurry making. There shall be no direct discharge to any water body.
9. The coal settling pits shall be cleaned and made operational alternatively all the time so that no waste water from CHP area/coal yard goes to outside bypassing the settling pits.
10. The unit shall ensure that no ash containing water from the ash pond area or due to leakages from ash pipe lines shall be discharged to Tikira river. In case there is any incidental discharge, the unit shall clean up the river bed and carry out regular monitoring of river quality to the Board.
11. The safety, stability of the ash dykes study shall be carried out by experts taking all hydraulic parameters into consideration.
12. The slurry pipe lines shall be aligned suitably in the lagoon of ash pond, so that ash is distributed uniformly.
13. The unit shall recycle the effluent of coal settling pit, over flow effluent and seepage effluent of the lagoon to the maximum extent.
14. The unit shall implement recommendations in the surface runoff study report.
15. The unit shall take utmost care to cover up exposed portion of the inactive ash pond and provide water sprinkling system to reduce fugitive dust.
16. Ash pond capacity augmentation shall be done to create volume for future storage.
17. Entire wastewater from leakages blow down and DM plant shall be recirculate.
18. The unit shall provide separate settling arrangement for surface runoff from dry ash silo area.

19. The storm water drains shall be maintained separately without being mixed up with the industrial effluent or sewage effluent.
20. The unit shall obtain authorization from the Board under Rule,9 of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and condition stipulated in authorization granted by the Board.
21. The industry shall abide by E(P) Act, 1986 and Rules framed there-under.
22. In case the consent fee is revised upward during this period, the industry shall pay the differential fees to the Board (for the remaining years) to keep the consent order in force. If they fail to pay the amount within the period stipulated by the Board the consent order will be revoked without prior notice.
23. The Board reserves the right to revoke/refuse consent to operate at any time during period for which consent is granted in case any violation is observed and to modify/stipulate additional conditions as deemed appropriate.
24. The industry shall take steps for fulfillment of all the stipulations and necessary measures to check pollution.
25. Consent to operate is subject to availability of all other statutory clearances required under relevant Acts/Rules and fulfillment of required procedural formalities.

G. Additional Conditions :

1. **The industry shall comply to the followings by 31.05.2019 and to furnish action taken report by 15.04.2019.**
   a) The raln cuts along the ash dyke shall be repaired and dyke shall be strengthened.
   b) Stop discharge of ash water to the premises of M/s. JITPL industry and through overflow lagoon to Bakulijhor nallah forthwith.
   c) The existing chemical dosing system at coal settling pit shall be repaired and operated.
   d) The existing surface runoff drainage shall be completely separated from the industrial drainage system.
   e) De-siltation of settling pits and drains of the entire plant shall be carried out periodically.
2. Online CEMS for Hg (Mercury) shall be installed in the stacks **by end of June 2019.**
3. The recirculation system of ash pond shall be effectively operated to achieve towards ZLD to prevent degradation of water quality of the nearby nallah and river Brahmani. This shall be achieved **by 31.05.2019.**
4. Surface runoff treatment system consisting of sedimentation through settling tanks/ ponds followed by high rate clarification through clari-floculator/ tube settlers shall be installed to meet the discharge norms and shall be completely recycled during dry season/ partly discharged specially during monsoon if unavoidable. This shall be achieved **by 31.05.2019.**
5. Domestic solid waste generated from colony, canteen, office complex etc. shall be processed through mechanically operated waste convertors with facility for recovery of useful products like oil/ gas/ carbon/ metal/ compost etc. The products to be used

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by the industry or sold and the inorganic residues is to be used for captive consumption/ sold/ disposed in sanitary landfill developed inside the premises. **This shall be achieved by 31.05.2019 .**

6. Fixed type wheel washing system shall be installed in ash silo area, coal stock yard and for the material transport vehicles at the exit gates to avoid carrying dust / ash along the wheels to the nearby public roads. The wash effluent shall be treated in settling pits and clear water shall be reused. **This shall be achieved by 31.05.2019.**
7. Online monitoring system for PM, SO_2, NO_X for thermal power plants as per CPCB guideline for OCEMS August, 2018 and Standards prescribed for these parameters by MoEF & CC Dt 7.12.2015 shall be complied.
8. The industry shall strictly follow the guideline of CPCB dated July 2018 for Online Continuous Effluent Monitoring Systems (OCEMS) and Guidelines for Continuous Emission Monitoring Systems dtd. August 2018 for PM and other gaseous parameters.
9. The industry shall ensure tampered proof real time transmission of online monitoring data to the server of CPCB and SPCB and maintain the health of the analyzers and data connectivity through valid AMC.

The occupier must comply with the conditions stipulated in section A,B,C,D,E F, G to keep this consent order valid.

To

The Chief General manager
M/s. Talcher Super Thermal Power Stations , NTPC Ltd.
PO-Deepsikha, Kaniha
Dist-Angul

22/3/19

MEMBER SECRETARY
State Pollution Control Board, Odisha

Memo No._____/Dt.

Copy forwarded to;

i) Regional Officer, State Pollution Control Board, **Angul**
ii) District Collector, **Angul**
iii) D.F.O, **Angul**
iv) Director, Mines, Govt. of Odisha.
v) Director Factories and Boilers, Bhubaneswar
iv) Consent Register
v) Sr. Env. Scientist (L)

CHIEF. ENV. ENGINEER
State Pollution Control Board, Odisha

P.T.O

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GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENT POLLUTANTS
PART-A: EFFLUENTS

Sl.No.	Parameters	Standards			
		Inland surface	Public sewers	Land for irrigation	Marine Costal Areas
		(a)	(b)	(c)	(d)
1.	Colour & odour	Colourless/Odourless as far as practible	------	See 6 of Annex-1	See 6 of Annex-1
2.	Suspended Solids (mg/l)	100	600	200	For process wastewater – 100 b. For cooling water effluent 10% above total suspended matter of influent.
3.	Particular size of SS	Shall pass 850	-----	------	
5.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6.	Temperature	Shall not exceed 5^0C above the receiving water temperature	-------	--------	Shall not exceed 5^0C above the receiving water temperature
7.	Oil & Grease mg/l max.	10	20	10	20
8.	Total residual chlorine	1.0	----	------	1.0
9.	Ammonical nitrogen (as N) mg/l max.	50	50	------	50
10.	Total Kajeldahl nitrogen (as NH_3) mg/1 max.	100	----	------	100
11.	Free ammonia (as NH_3) mg/1 max.	5.0	----	------	5.0
12.	Biochemical Oxygen Demand (5 days at (20^0C) mg/1 max.	30	350	100	100
13.	Chemical Oxygen Demand, mg/1 max.	250	----	------	250
14.	Arsenic (as As) mg/1 max.	0.2	0.2	0.2	0.2
15.	Mercury (as Hg) mg/1 max.	0.01	0.01	------	0.001
16.	Lead (as pb) mg/1 max.	01.	1.0	------	2.0

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17.	Cardmium (as Cd) mg/1 max.	2.0	1.0	------	2.0
18.	Hexavalent Chromium (as Cr + 6) mg/l max.	0.1	2.0	-------	1.0
19.	Total Chromium (as Cr) mg/l max.	2.0	2.0	---------	2.0
20.	Copper (as Cu) mg/l max.	3.0	3.0	---------	3.0
21.	Zinc (as Zn) mg/l max.	5.0	15	---------	15
22.	Selenium (as Sc) mg/l max.	0.05	0.05	---------	0.05
23.	Nickel (as Nil) mg/l max.	3.0	3.0	---------	5.0
24.	Cyanide (as CN) mg/l max.	0.2	2.0	0.2	0.02
25.	Fluoride (as F) mg/l max.	2.0	15	---------	15
26.	Dissolved Phosphates (as P) mg/l max.	5.0	-------	---------	--------
27.	Sulphide (as S) mg/l max.	2.0	--------	---------	5.0
28.	Phennolic compounds as (C_6H_5OH) mg/l max.	1.0	5.0	---------	5.0
29.	Radioactive materials a. Alpha emitter micro curle/ml. b. Beta emitter micro curle/ml.	10^7 10^6	10^7 10^6	10^8 10^7	10^7 10^6
30.	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
31	Manganese (as Mn)	2 mg/l	2 mg/l	---------	2 mg/l
32.	Iron (Fe)	3 mg/l	3 mg/l	---------	3 mg/l
33.	Vanadium (as V)	0.2 mg/l	0.2 mg/l	---------	0.2 mg/l
34.	Nitrate Nitrogen	10 mg/l	--------	---------	20 mg/l

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PART- B:NATIONAL AMBIENT AIR QUALITY STANDARDS

Sl. No.	Pollutants	Time Weighed Average	Concentrate of Ambient Air		
			Industrial Residential, Rural and other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1.	Sulphur Dioxide (SO_2), $\mu g/m^3$	Annual *	50	20	-Improved west and Gaeke
		24 Hours **	80	80	- Ultraviolet fluorescence
2.	Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual *	40	30	- Modified Jacob & Hochheiser (Na-Arsenite)
		24 Hours **	80	80	- Chemiluminescence
3.	Particulate Matter (size less than 10µm) or $PM_{10}\mu g/m^3$	Annual *	60	60	-Gravimetric - TOEM
		24 Hours **	100	100	- Beta Attenuation
4.	Particulate Matter (size less than 2.5µm) or $PM_{2.5}\ \mu g/m^3$	Annual *	40	40	-Gravimetric - TOEM
		24 Hours **	60	60	- Beta Attenuation
5.	Ozone (O_3) $\mu g/m^3$	8 Hours **	100	100	- UV Photometric - Chemiluminescence
		1 Hours **	180	180	- Chemical Method
6.	Lead (Pb) $\mu g/m^3$	Annual *	0.50	0.50	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper. - ED-XRF using Teflon filter
		24 Hours **	1.0	1.0	
7.	Carbon Monoxide (CO) mg/m^3	8 Hours **	02	02	- Non Dispersive Infra Red (NDIR) Spectroscopy
		1 Hours **	04	04	
8.	Ammonia (NH_3) $\mu g/m^3$	Annual*	100	100	-Chemiluminescence - Indophenol Blue Method
		24 Hours**	400	400	
9.	Benzene (C_6H_6) $\mu g/m^3$	Annul *	05	05	-Gas Chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10.	Benzo (a) Pyrene (BaP)-Particulate phase only, ng/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11.	Arsenic (As), ng/m^3	Annual*	06	06	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12.	Nickel (Ni),ng/m^3	Annual*	20	20	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

** Annual arithmetic mean of minimum I04 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 0I hourly monitored values, as applicable, shall be complied with 98% of the time in a year, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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Annexure- I

4928
9-4 (65)

Office of the Executive Engineer
Head Works Division, Samal
At:/P.O Samal Barrage Township,Dist: Angul
e-mail.id :(ee.hwd.samal@gmail.com) (eehwsamal-eicwr.od@nic.in)

Lr. No. : HWD/Estr./2019-20 1469 -73 /WE / Dated 26/3/19

NSQ CW 9/4/19

To

1. The General Manager (O & M), M/s N.T.P.C. Ltd.
   At/P.O. : Deepsikha, Kaniha, Dist : Angul.
2. The General Manager, M/s Jindal India Thermal Power Ltd.
   At/P.O. : Derang, Dist : Angul.
3. The Asst. Vice President, M/s Jindal Steel & Power Ltd.
   At/P.O. : Jindal Nagar, Dist : Angul.
4. The Plant Superintendent, M/s Odisha Power Consortium Ltd.
   Samal Barrage Township, Dist : Angul.

AGM(EEMG)

Sub : Enhancement of license fee/ Special Water rate w.e.f. 01.04.2019 .

Ref : Letter No. 10718/WE Dtd. 04.04.2018.

Sir,

In enclosing herewith the letter on the subject cited above, it is to intimate that as per Odisha Irrigation (Amendment) Rules, 2016, 23 A (2) (f) , the license fees for drawal of water shall be enhanced @10% per annum w.e.f. 1st day of April every year . As the amendment came into force w.e.f. the date of publication in Odisha Gazette i.e. 27.09.2016, the first and 2nd enhancement of rate has been made from 1st April 2017 and 1st April 2018 respectively.

Accordingly, the 3rd enhancement of license fees @ 10% on water cess will be effective from 01.04.2019 as it has already been clarified in the letter under reference that, the enhancement @10% per annum shall be effected only on and over the original rates in the schedule II & III of Odisha Irrigation (Amendment) Rules, 1961 from the 1st day of April every year i.e. Rs. 5.60/ M^3.

Therefore, you are requested to pay the water cess with respect to the approved schedule and the advance water tax calculation sheet basing on the enhanced rate by Govt. in DoWR is enclosed herewith for your information and necessary action at your end.

Encl : As above

Yours faithfully,

26/3/19
Executive Engineer,
Head Works Division, Samal

Memo No. 1473 -74 /WE /Dated 26/3/19

Copy along with the enclosures submitted to the Engineer-in-Chief-cum-Spl. Secretary to Govt. Water Resources, Odisha, Bhubaneswar/ Engineer-in-Chief, Water Resources, Secha Sadan, Odisha, Bhubaneswar for favour of kind information and necessary action.

26/3/19
Executive Engineer

P.t.o....

06/4/19

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Memo No. 1475-76/WB /Dated 26/3/19

Copy along with the enclosures submitted to the Chief Engineer, Water Services, Secha Sadan, BBSR/ Chief Engineer & Basin Manager, Brahmani Basin, Samal for favour of kind information and necessary action.

26/3/19
Executive Engineer

Memo No. 1477/WB /Dated 26/3/19

Copy along with the enclosures submitted to the Addl. Project Director-cum-C.C.E., Rengali Irrigation Project, Samal for favour of kind information and necessary action.

26/3/19
Executive Engineer

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