



National Electric Power Regulatory Authority
Islamic Republic of Pakistan

Registrar

2nd Floor, OPF Building, G-5/2, Islamabad.
Ph : 9207200 Ext : 330 — Fax : 9210215
E-mail : office@nepra.isb.sdnpk.org
Direct Phone : (051) 9206500

No. LAG 03/3589-90

01 July 2002

Chief Executive Officer,
M/s. Northern Power Generation Co. Ltd.
(GENCO-III),
172-WAPDA House,
Lahore
Tele: 042-9202529

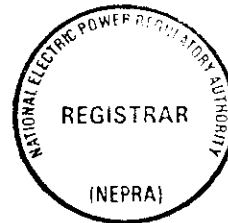
**Subject: Grant of Generation Licence GL/03/2002
Licence Application No. LAG 03
M/s. Northern Power Generation Co. Ltd.**

Please refer to your application No. CEO/NPGC/12/156-57, dated 25 May 2001, for a Generation Licence.

2. Enclosed here is Generation Licence No. GL/03/2002 granted by the Authority to M/s. Northern Power Generation Co. Ltd. The Licence is granted to you pursuant to Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997).

3. Please quote above mentioned Generation Licence No. in your future correspondence with the Authority.

DA/As above.



(Handwritten signature)
1.07.2002
(Mahjoob Ahmad Mirza)

Copy for information to Director General, Pakistan Environmental Protection Agency, 44-E, Office Tower, Blue Area, Islamabad.

GENERATION LICENCE

**NORTHERN POWER GENERATION
COMPANY LIMITED**

TERM OF THE LICENCE

TERM OF THE LICENCE

(Article 4 of the Licence)

NORTHERN POWER GENERATION COMPANY LIMITED

The Rule 5 of the Licensing (Generation) Rules – 2000 stipulates that the Term of the Licence shall be commensurate with the maximum expected useful life of the units comprised in a generation facility demonstrated to the satisfaction of the Authority unless the applicant consents to a shorter period.

Northern Power Generation Company Limited has shown in its Generation Licence application Ref. No. CEO/NPGC/12/114 dated 28th April, 2001 to NEPRA, expected remaining life of all of its generation facilities, also included in Schedule-I of this Licence.

The Applicant has claimed the maximum expected remaining life as 30 years for its Steam Power Generating Units installed at Thermal Power Station Muzaffargarh. The Applicant has claimed expected useful life of Power Generating units as 10, 10 and 5 years for its plants SPS Faisalabad, GTPS Faisalabad, and NGPS Multan respectively.

The Licensing Group considers that Steam Power Generating Units normally have a useful life of around 30 years; and the Gas Turbine Generating Units around 20-25 years. The units at Thermal Power Station Muzaffargarh were commissioned during the period 1993 to December 1997.

In view of all the details provided with the licence application including the date of commissioning of generating units and normal expected life for the plants of same type and technology, the Licensing group does not agree with the maximum expected remaining life claimed by the applicant of its generation facilities. The Group recommends that the Generation Licence be issued to Northern Generation Power Company Limited by the Authority for a period of **Twenty - Five (25) years** from the date of Grant of this Licence by the Authority.

AUTHORITY DECISION

The Authority agrees with the Licensing Group recommendations about the Term of the Licence. The Licence is granted for a term of **Twenty-Five (25) Years**.

AUTHORITY

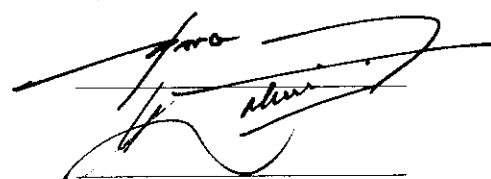
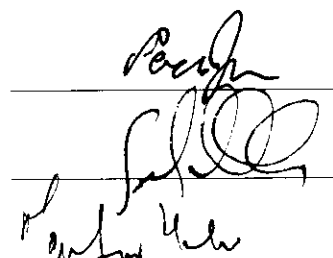
Justice (R) Saad Saood Jan, Chairman

Mr. Fazlullah Qureshi Vice Chairman

Mr. Mansoor Elahi, Member

Sardar Muhammad Sharif Khan T. St., Member

Mr. Abdul Rahim Khan, Member



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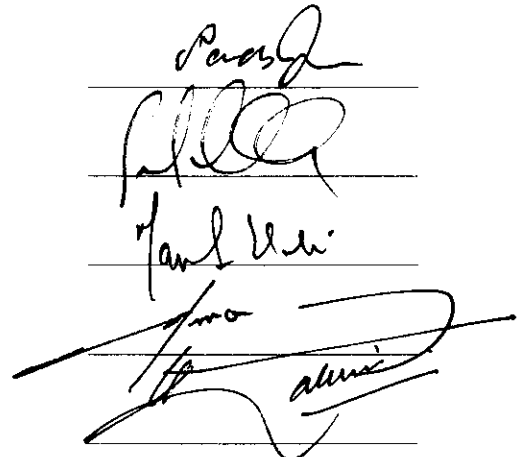
Justice (R) Saad Saood Jan, Chairman

Mr. Fazlullah Qureshi Vice Chairman

Mr. Mansoor Elahi, Member

Sardar Muhammad Sharif Khan T. St., Member

Mr. Abdul Rahim Khan, Member



The image shows four handwritten signatures, each written over a horizontal line. The signatures are: 1. Justice (R) Saad Saood Jan, 2. Mr. Fazlullah Qureshi, 3. Mr. Mansoor Elahi, and 4. Sardar Muhammad Sharif Khan T. St. The signatures are written in black ink and are somewhat stylized.

**National Electric Power Regulatory Authority
(NEPRA)**

Islamabad - Pakistan

GENERATION LICENCE

NO. GL/03/2002

In exercise of the Powers conferred upon the National Electric Power Regulatory Authority (NEPRA) under Section 15 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997), the Authority hereby grants a Generation Licence to: -

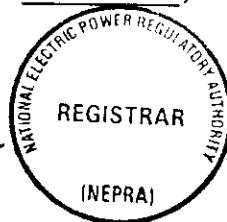
**NORTHERN POWER GENERATION
COMPANY LIMITED**

Incorporated under the Companies Ordinance, 1984
under Certificate of Incorporation
No. L 09667 of 1998-99 dated 15th October, 1998

to engage in generation business subject to and in accordance with the Articles of this Licence.

Given under my hand this 1st day of July, Two Thousand & Two, and expires on 30th day of June, Two Thousand & Twenty Seven.

afjond 1.07.2002
Signed



Article 1

Definitions

In this Licence:

“Act” means the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997);

“Authority” means the National Electric Power Regulatory Authority constituted under Section 3 of the Act;

“Licensee” means Northern Power Generation Company Limited; and

“Rules” means the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000.

Words and expressions used but not defined herein bear the meaning given thereto in the Act or in the Rules.

Article 2

Application of Rules

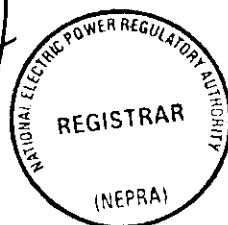
This Licence is issued subject to the provisions of the Rules, as amended from time to time.

Article 3

Generation Facilities

The location, size, technology, interconnection arrangements, technical limits, technical functional specifications and other details specific to the generation facilities of the Licensee are set out in Schedule I to this Licence.

The net capacity of the generation facilities is set out in Schedule II hereto.



Article 4

Term

This Licence is granted for a term of **Twenty-Five (25) years**.

Article 5

Licence Fee

The Licensee shall pay to the Authority the licence fee in the amount and manner and at the time specified in the National Electric Power Regulatory Authority (Fees) Rules, 2002.

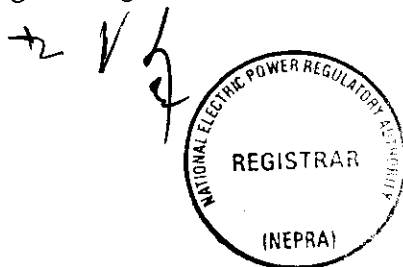
Article 6

Competitive Trading Arrangement

- (1) The Licensee shall participate in such measures as may be directed by the Authority from time to time for development of a Competitive Trading Arrangement. The Licensee shall in good faith work towards implementation and operation of the aforesaid Competitive Trading Arrangement in the manner and time period specified by the Authority:

Provided that, any such participation shall be subject to:

- (a) any contract entered into by and between the Licensee and another party prior to the enactment of the Act and for the due performance of which a sovereign guarantee has been provided by the Government of Pakistan; or
 - (b) any contract entered into by and between the Licensee and another party subsequent to the enactment of the Act with the approval of the Authority.
- (2) Any variation or modification in the above-mentioned contracts for allowing the parties thereto to participate wholly or partially in the Competitive Trading Arrangement shall be subject to mutual agreement of the parties



thereto and such terms and conditions as may be approved by the Authority.

Article 7

Maintenance of Records

For the purpose of sub-rule (1) of Rule 19, copies of records and data shall also be retained in electronic form and all such records and data shall, subject to just claims of confidentiality, be accessible by authorized officers of the Authority.

Article 8

Compliance with Performance Standards

The Licensee shall conform to the relevant rules on performance standards as may be prescribed by the Authority from time to time.

Article 9

Compliance with Environmental Standards

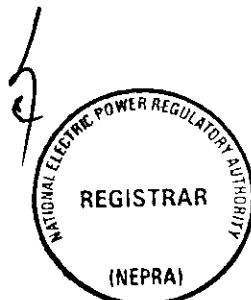
The Licensee shall conform to the environmental standards as may be prescribed by the relevant competent authority from time to time.

Article 10

Provision of Information

Without prejudice to the obligation of the Licensee to comply with any call for information made by the Authority from time to time under section 44 of the Act, the Licensee shall submit to the Authority the following statements of availability of the generation facilities:

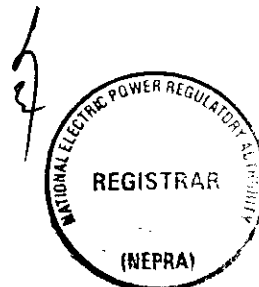
#2 ✓



- (1) Within three (3) months of the beginning of a financial year, the licensee shall prepare and submit before the Authority for its approval, the criteria upon which the licensee will:
 - (a) determine the duration and timing of planned outages of generation units;
 - (b) determine which hours of the day and days of the week a generation unit which is not subject to a planned outage will be sufficiently manned to be capable of being made available;
 - (c) determine its policy for making available generation units which are not subject to planned outages; and
 - (d) determine its policy for the temporary or permanent closure of generation units.

- (2) No later than one (1) month before the end of a financial year, the licensee shall submit to the Authority a written forecast for each generation unit expected to operate in the following financial year stating:
 - (a) the net capacity of the unit;
 - (b) the planned outage schedule of each unit;
 - (c) best estimates of unplanned outages for each unit;
 - (d) the means by which the unit will be fuelled or expected to be primarily fuelled in the case of dual firing units;
 - (e) best expectation of any unplanned outages; and
 - (f) the factors known to the licensee likely to affect the number of outages.

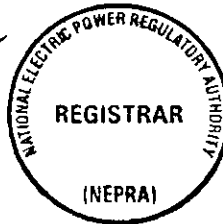
✓



- (3) No later than six (6) months into each financial year, the licensee shall submit to the Authority any changes to the best estimates submitted to the Authority under Article 10(2) above with respect to the remainder of the financial year.
 - (4) Within three (3) months of the beginning of each financial year, the licensee shall submit to the Authority a statement of actual availability of each generation unit during the previous financial year. The said statement shall compare forecasts and plans made for the previous financial year against outturns.
-

#2 ✓

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SCHEDULE - I

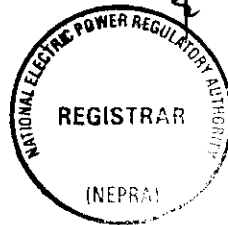
- The location, size (capacity in MW), technology, interconnection arrangements, technical limits, technical functional specifications and other details specific to the generation facilities of the licensee

V-2



INTRODUCTION

V + 2



INTRODUCTION

Northern Power Generation Company consists of four Thermal power plants located in the Province of Punjab having a total installed capacity of 1921 MW. Half of the plants have practically served their economic lives. In all, 20 Units are installed in the company which include eleven steam units, eight gas turbine units and one combined cycle unit.

Northern Power Generation Company Limited comprises of following Power Plants:

- (1) Thermal Power Station Muzaffargarh.
- (2) Natural Gas Power Station Multan.
- (3) Gas Turbine Power Station Faisalabad.
- (4) Steam Power Station Faisalabad.

1. THERMAL POWER STATION (TPS) MUZAFFARGARH

The detail of Power station showing, number of units, installed capacity, rated capacity, make, year of commissioning and fuel used is given below:

Unit No.	Installed Capacity	Make	Commissioning Date	Fuel Type
ST-1	210 MW	M/s T.P.E. USSR	Sep. 1993	P.Gas, F. Oil
ST-2	210 MW	M/s T.P.E. USSR	Mar. 1994	P.Gas, F. Oil
ST-3	210 MW	M/s T.P.E. USSR	Feb. 1995	P.Gas, F. Oil
ST-4	320 MW	M/s CMEC China	Dec. 1997	P.Gas, F. Oil
ST-5	200 MW	M/s CMEC China	Dec. 1995	P.Gas, F. Oil
ST-6	200 MW	M/s CMEC China	Dec. 1995	P.Gas, F. Oil
Total	1350 MW			

A. Location

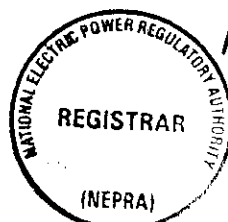
TPS Muzaffargarh is located in the middle of the country between the River Indus and River Chenab, 2.5 Km to North-West of Muzaffargarh Town in District Muzaffargarh. The nearest Air port facility is at Multan at a distance of NorthEast of Muzaffargarh.

B. Installed Capacity

This Power Station is a vital and major thermal power generating installation connected with the National grid system. This Power Station was constructed in different Phases with a total capacity of 1350 MW. It consists of three Russian units of 210 MW each of M/S TPE, two Chinese units of 200 MW each of M/S CMEC and one Chinese unit of 320 MW of M/S CMEC.

C. Fuel

Dual fuel combustion provision (Gas & Furnace Oil) has been made for all the machines. Furnace oil is transported through Railway Wagons and tank lorries. The maximum gas requirement is 300 MMCF per day. No gas allocation exists. However the gas is supplied only when available.



2. Natural Gas Power Station (NGPS) Multan

The detail of Power station showing, number of units, installed capacity, rated capacity, make, year of commissioning and fuel used is given below:

Unit No.	Installed Capacity	Make	Commissioning Date	Fuel Type
ST-1	65 MW	M/s AEG Germany	May 1960	P.Gas, F. Oil
ST-3	65 MW	M/s AEG Germany	Jul. 1963	P.Gas,F. Oil
ST-4	65 MW	M/s AEG Germany	Nov. 1963	P.Gas, F. Oil
Total	195 MW			

Note: ST-2 after 178657 Hrs. operation cracks have developed at the high pressure turbine casing, due to higher repair/replacement cost the Steam Turbine is out of operation since September 1995.

A. Location

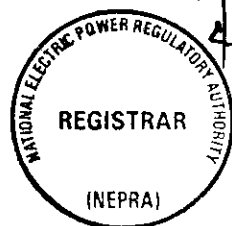
Power Station is located at Piranghaib about one Km towards North from Piranghaib Railway station and at a distance of 10 Km from Multan city towards East.

B. Installed Capacity

The Power Station initially comprised of four identical units of 65 MW each having total capacity of 260 MW. Unit No. 2 is out of operation due to cracks at the high pressure turbine casing of and is un-operative since 17.09.1995. As per Authority decision its major parts i.e. H.P. Rotor/6 K.V. Motors have been cannibalized on other units and hence remains redundant.

C. Fuel

Dual fuel combustion provision (Gas & Furnace Oil) has been made for all the machines. 15 MMCFD per day gas is allocated and the short fall is met with furnace oil firing.



3. Gas Turbine Power Station (GTPS) Faisalabad

The detail of Power station showing, number of units, installed capacity, rated capacity, make, year of commissioning and fuel used is given below:

Unit No.	Installed Capacity	Make	Commissioning Date	Fuel Type
GT-1	25 MW	M/s AEG KANIS Germany	Mar. 1975	P.Gas, HSD
GT-2	25 MW	-do-	Mar. 1975	-do-
GT-3	25 MW	-do-	May 1975	-do-
GT-4	25 MW	-do-	Mar. 1975	-do-
GT-5	25 MW	-do-	Jul. 1975	-do-
GT-6	25 MW	-do-	Jul. 1975	-do-
GT-7	25 MW	-do-	Jul. 1975	-do-
GT-8	25 MW	-do-	Nov. 1975	-do-
CC-9 (GT-5-8)	44 MW	-do-	Dec. 1994	-do-
Total:	244 MW			

A. Location

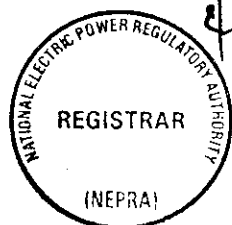
This Power Station is situated at 10 Km from Faisalabad city on Faisalabad-Sheikhpura road. Nishatabad railway station is 04 Km in the West and Rakh branch canal flows close to the power station in the East.

B. Installed Capacity

Power Station comprises of 08 x 25 Mw Gas Turbines of AEG KANIS Germany make and one Combined Cycle unit of 44 Mw from Harbin Turbine works China.

C. Fuel

Dual fuel combustion provision (Gas & HSD Oil) has been made for all the machines. Gas allocation of 26 MMCFT per day is available subject to availability.



4. STEAM POWER STATION (SPS) FAISALABAD

The detail of Power station showing, number of units, installed capacity, rated capacity, make, year of commissioning and fuel used is given below:

Unit No.	Installed Capacity	Make	Commissioning Date	Fuel Type
ST-1	66 MW	M/s Westing House USA	Jun. 1967	P.Gas, F.O
ST-2	66 MW	M/s Westing House USA	Nov. 1967	P.Gas, F.O
Total	132 MW			

A. Location

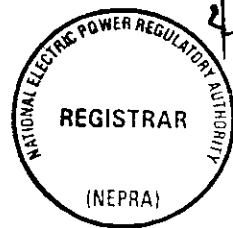
This Power Station is situated at 10 Km from Faisalabad city on Faisalabad -Sheikhpura road. Nishatabad railway station is 04 Km in the West and Rakh branch canal flows close to the power station in the East.

B. Installed Capacity

The Power Station comprises of two identical units of 66 MW each of M/S Westinghouse of USA, having total installed capacity of 132 MW.

C. Fuel

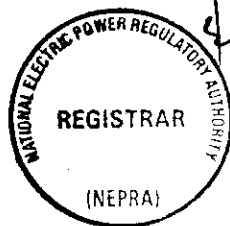
Dual fuel combustion provision (Gas & Furnace Oil) has been made for all the machines. Requirement of Gas on 70% load factor is about 22 MMCFT. Furnace oil is used to meet with short fall of Gas quota.



SECTION - A

TPS MUZAFFARGARH

V #2



INFORMATION AS PER SCHEDULE- III (REGULATION 3 (6))

THERMAL POWER STATION MUZAFFARGARH

1. Location

Thermal Power Station is located in the center of country at Mauza Rakh Khanpur, Muzaffargarh district at a distance of 6 K.M from Muzaffargarh city. Absolute grade level is about 125 meter.

The nearest Airport facility exists at Multan at a distance of 45 KM north-east of Muzaffargarh. Railway Station of Muzaffargarh and Multan Cantt. are also available for journeys in the country. An Airport at D.G. Khan has recently been put in service providing a link with Karachi, Lahore & Quetta. Location map enclosed (Annexure A1,2)

2. Technology, Number of Units

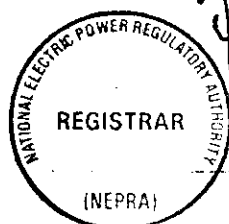
There are six (6) Conventional Steam Power Generating Units installed and are in operation at Thermal Power Station Muzaffargarh. Phase-1 consists of 3 Steam Power Units of capacity 210 MW each commissioned in 1993, 1994 and 1995 with assistance and co-operation of Ex-USSR. Main contractor was M/s 'TECHNOPROMEXPORT' for supply of equipment, erection and commissioning.

Phase-II comprises of 3 Steam Units (4,5&6) out of which Unit 5&6 of capacity 210 MW each, were put into commercial operation with the assistance and co-operation of Peoples Republic of China in 1995. Unit No.4 of capacity 320 MW was also constructed with the assistance and cooperation of Peoples Republic of China and was started for commercial operation in December 1997. The main contractors for supply of equipment, erection, testing and commissioning of Unit No.4 were M/s China National Machinery and Equipment Import and Export Corporation (CMEC) China. The Unit was first time synchronized with National Grid on 31.12.1996. The actual commissioning / commercial operation date of this Unit is 23.12.1997.

Technical Data attached as Annexure-H.

3. Fuel Type, imported / indigenous, Amount, Supplier, Logistics, Pipeline etc.

- a) Furnace Oil Supplied by M/s Pakistan State Oil and M/s Shell Pakistan Ltd.
- b) Natural Gas Supplied by M/s SNGPL Gas



c) Fuel supply requirement :

Unit No.	F.O. Requirement per day (M.T)	Gas Requirement MMCFD	HSD Requirement per year.
1,2 & 3	3600	114	1000 M ³
4	1800	50 - 70	-
5 & 6	2400	76	-

d) F.O. Logistics (Decanting Facility)

As per Annexure - B.

e) Pipe Line

Gas Pipeline diameter = 16 inches

4. Emission Values

As per Annexure - C.

5. Cooling water source.

Sr.No	Unit No.	Requirement (Cusec)	No. of Tube Wells	Capacity (Cusec)
1	1,2 & 3	21	16	48
2	4	15	10	03
3	5 & 6	14	9	27
Total		50	35	78

6. Interconnection with national grid company, distance and name of the grid, voltages level.

Single line diagram attached as per Annexure - D.

7. Installed capacity, Derated capacity, Expected remaining life

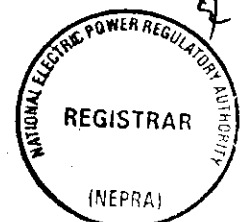
Unit No.	Installed Capacity (MW)	Derated Capacity (MW)	Expected Remaining Life (Years)
1	210	200	30
2	210	200	30
3	210	200	30
4	320	300	30
5	200	200	30
6	200	200	30

8. Due Diligence Report

Enclosed separately.

9. Rehabilitation plans, previous rehabilitation programme

Enclosed as per Annexure - E



10. **Operational record with environment monitoring data for the last five years**

Enclosed as per Annexure – F, F –1.

11. **Plant cost information on source and amount of equity and debt**

Enclosed as per Annexure - G.

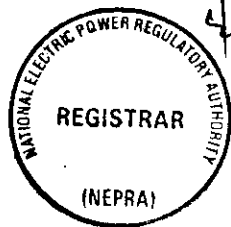
12. **Plant Characteristics; Generation Voltage, Frequency, Power Factor, Auxiliary Consumption, Time (s) Required to Synchronize to Grid is as below**

Unit No.	Generation Voltage (KV)	Frequency (HZ)	Power Factor	Auxiliary Consumption (%)	Time Required to Synchronize (Hours)
1	15.75	50	0.85	6	2-6
2	15.75	50	0.85	6	2-6
3	15.75	50	0.85	6	2-6
4	19.50	50	0.85	8	3-4
5	15.75	50	0.85	9	3-5
6	15.75	50	0.85	9	3-5

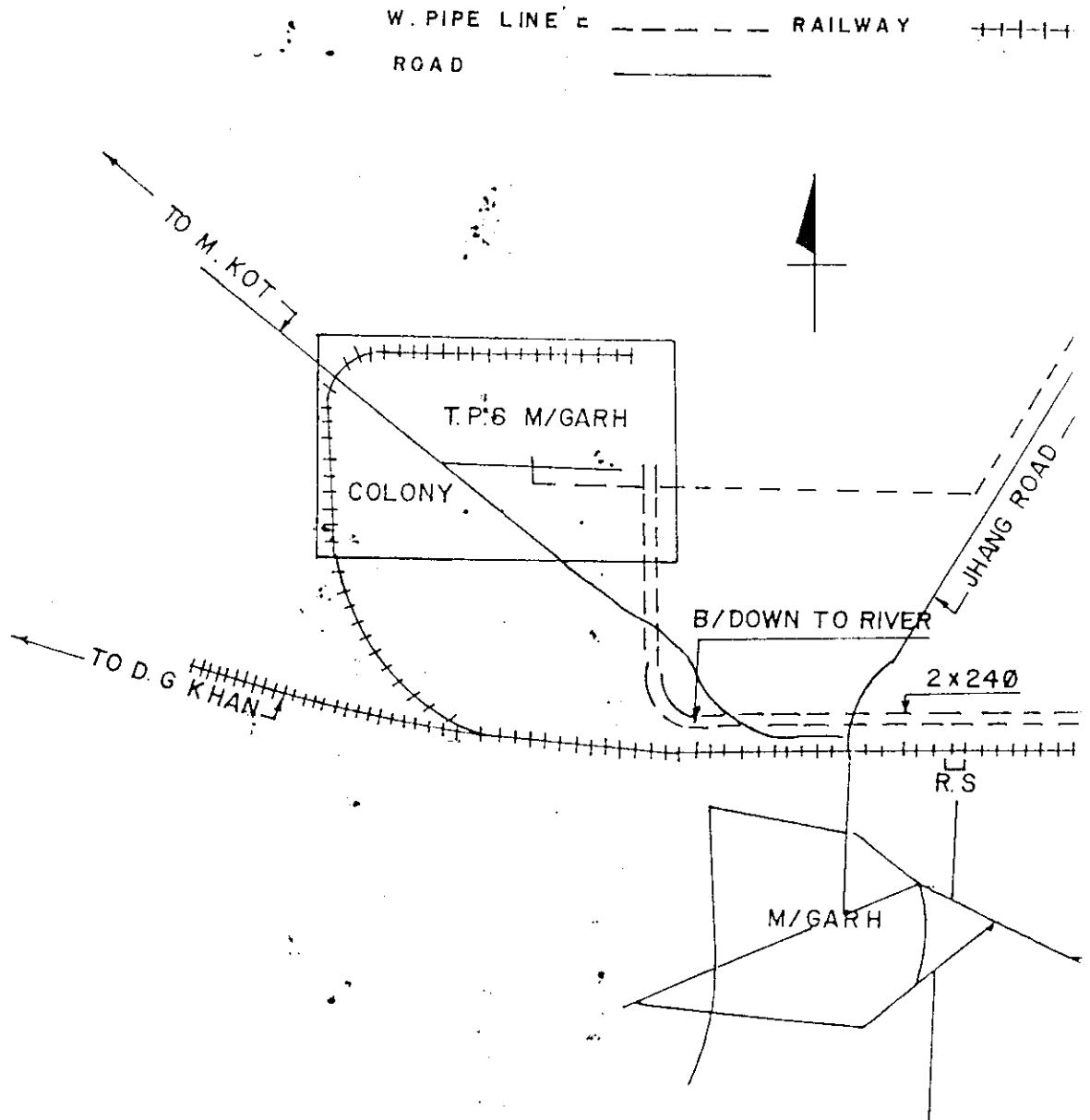
13. **Training and Development.**

A training center under the supervision of Director Training has the facilities for the Operation and Maintenance training of Engineers and staff.

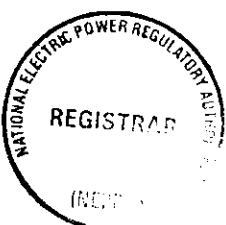
V+2



SITE LOCATION PLAN

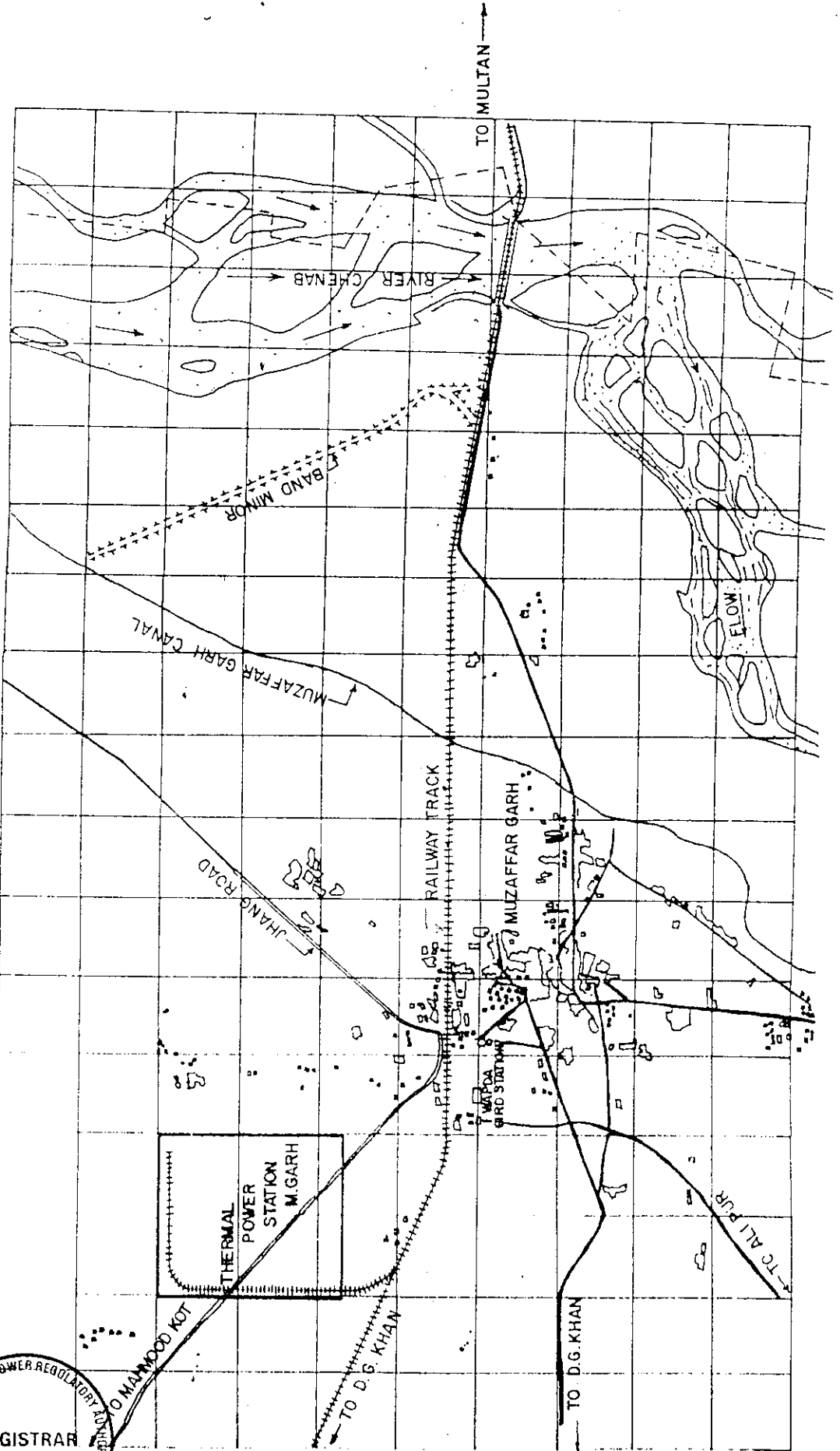
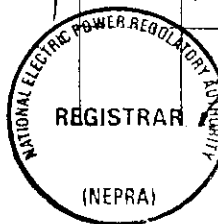


AREA OF ACQUIRED LAND	=	1134 ACRES
AREA OF POWER HOUSE	=	325 ACRES
AREA OF COLONY	=	262 ACRES
GROUND LEVEL AT POWER HOUSE	=	405.08 ft
GROUND LEVEL AT COLONY AREA	Phase I =	393.72 ft
	Phase II =	394.70 ft
ELEVATION OF RIVER PROTECTION BUND		
	1st Defence =	400.76 ft
	2nd Defence =	399.11 ft
WORST FLOOD LEVEL IN 1976	=	393.11 ft



ANNEX - A-2

THERMAL POWER STATION MUZAFFARGARH

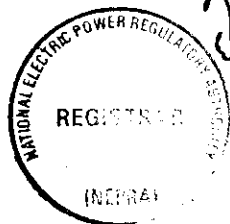


DAILY DECANTATION AT TPS MUZAFFARGARH

Phase	Oil Dumped to Pit			Pumping capacity to tanks
	Road Tankers	Railway Wagons	Total	
Phase-I	100 -150 Nos. (300 Tons)	Two Oil Special (2000 Tons)	5000 Tons	4 x 150 M ³ /hr
Phase-II	-	Two Oil Special (2000 Tons)	2000 Tons	4 x 200 M ³ /hr
Phase-III	-	Two Oil Special (2000 Tons)	2000 Tons	4 x 160 M ³ /hr
Total	3000 Tons	6000 Tons	9000 Tons	

OIL REQUIREMENT

Unit Ratings		Consumption / Day
Unit No.1	210 MW	1200 MT
Unit No.2	210 MW	1200 MT
Unit No.3	210 MW	1200 MT
Unit No.4	320 MW	1800 MT
Unit No.5	200 MW	1200 MT
Unit No.6	200 MW	1200 MT
Total		7750 MT/ Day



Annexure - C

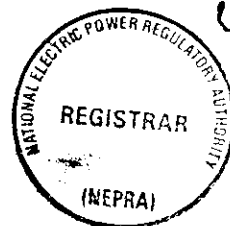
THERMAL POWER STATION MUZAFFARGARH

Emissions Data July 1995 to June 2000

Year	Fuel Consumption		Emissions												Total Emissions										
	F.O Tons	HSD Tons	Gas		On F.O (Tons)				On Gas (Tons)				On HSD (Tons)				Tons/Year				Tons/Day				
			MCF	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2		
1995-96	1188838		627	65386	13315	3567	3705212	46	1.4	36151	0	0	0	0	0	0	0	65386	13361	3568	3741362	179	37	10	1025
1996-97	965897		8561	53124	10818	2898	3010379	629	19	493599	0	0	0	0	0	0	0	53124	11447	2917	3503978	146	31	8	960
1997-98	9682	51.85	409.4	533	108	29	30176	30	1	23607	1	1	1	134	534	139	30	53782	1	0	0	1	0	0	145
1998-99			6878	0	0	0	0	506	16	396563	0	0	0	0	0	0	0	0	506	16	396563	0	1	0	108
1999-00	3059157		20981	168254	34263	9177	9534373	1542	48	1209695	0	0	0	0	168254	35805	9225	10744067	461	98	25	2943			

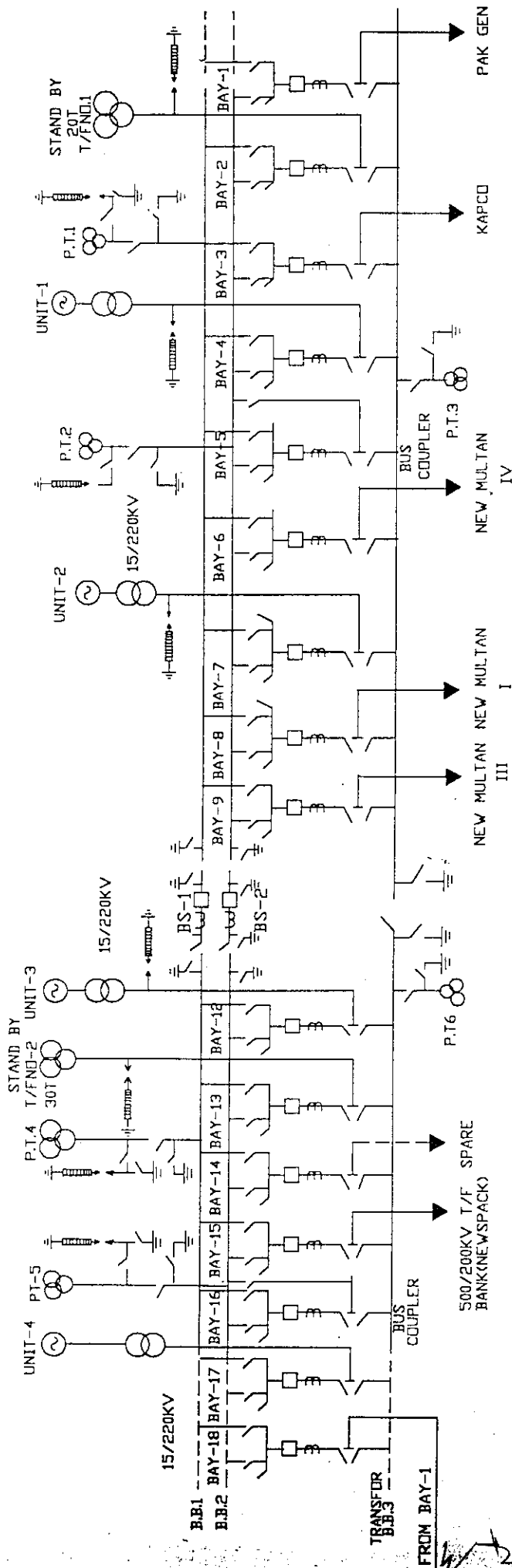
SOx Emissions Standards

WHO Standards 235 Tons/Day
Pakistan Standards 500 Tons/Day
World Bank Standards 500 Tons/Day



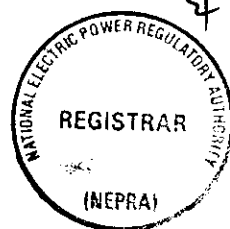
ANNEXURE - D

MUZAFFARGARH
220KV SWITCHYARD
PHASE - 1



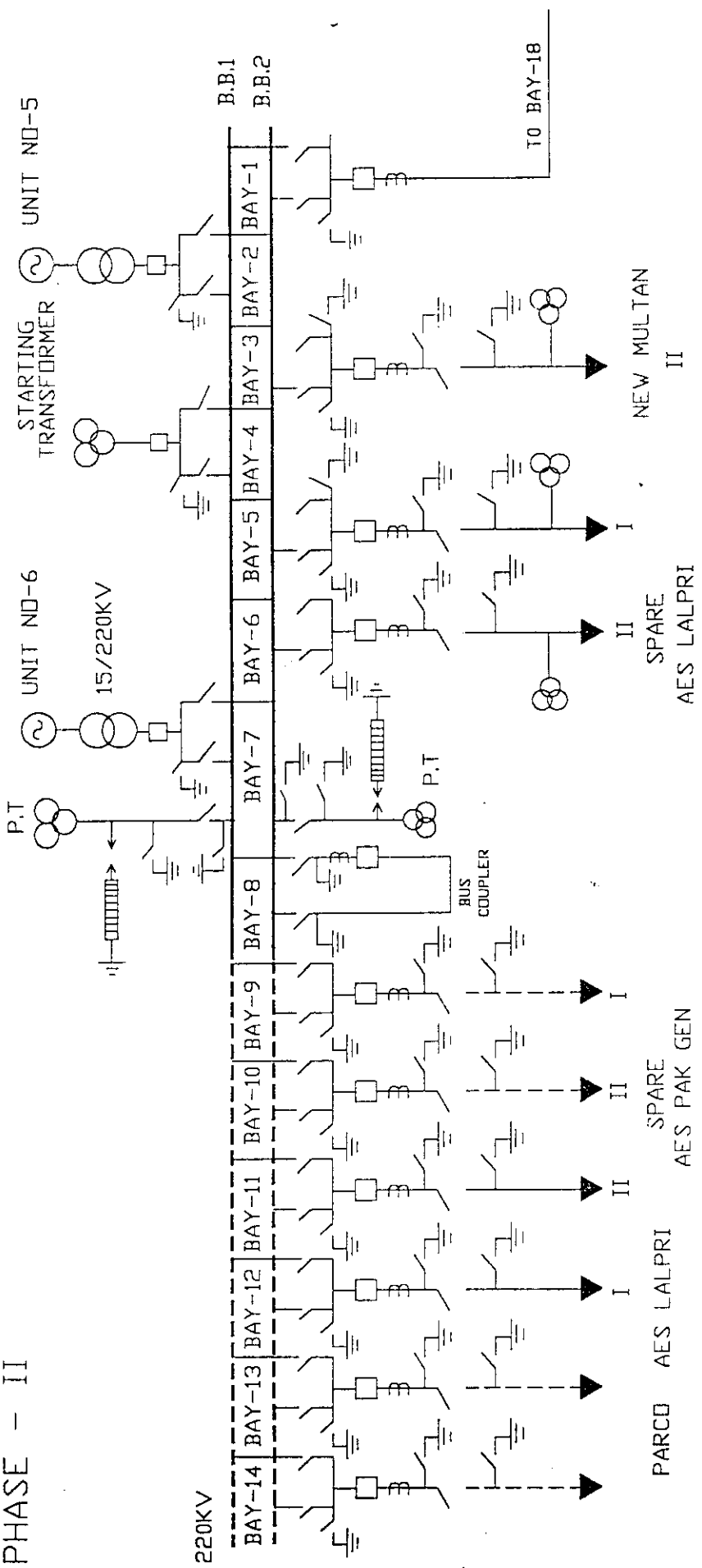
LEGEND

⊙	CURRENT TRANSFORMER	⊙	GENERATOR
⊕	LIGHTNING ARRESTER	⊕	UNIT TRANSFORMER
⊖	ISOLATOR	⊖	POTENTIAL TRANSFORMER
⊗	EARTHING KNIFE SWITCH	⊗	CIRCUIT BREAKER

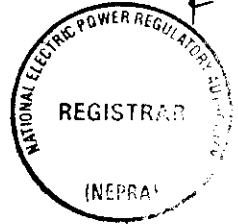


ANNEXURE-D

MUZAFFARGARH
220KV SWITCHYARD
PHASE - II



LEGEND	
	CURRENT TRANSFORMER
	LIGHTNING ARRESTER
	ISOLATOR
	EARTHING KNIFE SWITCH
	GENERATOR
	UNIT TRANSFORMER
	POTENTIAL TRANSFORMER
	CIRCUIT BREAKER



MAJOR EQUIPMENT SPECIFICATIONS

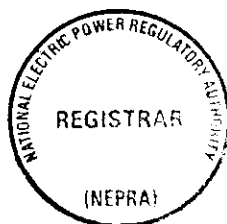
A - UNIT NO. 1,2 & 3

TURBINE

Type of Steam Turbine	Single Shaft Three Cylinder Condensing Turbine.
High Press. Steam Turbine	12 Stages, the 1st one is the Control Stage.
High Press. Steam Turbine	11 Pressure Stages
Low Press. Steam Turbine	3 Pressure Stages in double flow arrangement.
Rated Power of Steam Turbine	21 MW
Rated Speed of Steam Turbine	3000 RPM
Max. Steam flow rate through Turbine	670 Ton/Hr.
Rated Steam Flow Rate	640 ^o C
Steam Flow Rate at Idle Stroke	30 Ton/Hr.
Steam Temp. before HPC	540 ^o C
Absolute Press. of Steam before HPC	12.7 Mpa (130 kgf/cm ²)
Steam Temp. behind HPC	320 ^o C
Absolute Press. of Steam behind HPC	2.76 Mpa (28.1 kgf/cm ²)
Reheated Steam Temp. before MPC	540 ^o C
Absolute Reheated Steam Press. before MPC	2.42 Mpa (24.17 kgf/cm ²)
Absolute Press. in condenser	0.0098 Mpa (01.1 kgf/cm ²)
Rated C.W Temp. at Condenser Inlet.	32 ^o C
Max. C.W Temp. at condenser Inlet.	40 ^o C
C.W Flow Rate	27500 m ³ /hr.

BOILER

Superheated Steam Output	670 Ton/Hr.
Reheat Steam Flow	570 Ton/Hr.
Superheated Steam Temp.	545 ^o C
Superheated Steam Press. at Boiler Outlet	13.8 Mpa (140 kgf/cm ²)
Steam Temp. at Reheater Inlet	333 ^o C
Steam Temp. at Reheater Outlet	545 ^o C
Steam Press. at Reheater Inlet	2.7 Mpa (27.5 kgf/cm ²)
Steam Press Reheater Outlet	2.5 Mpa (25.5 kgf/cm ²)
Feed Water Temp.	247 ^o C
Boiler Efficiency (on F.O. firing)	93 ^o C
Min. Continuous Loading	30 %
Boiler Drum Inside Diameter	1600 mm
Wall Thickness	112 mm
Drum Length	22500 mm



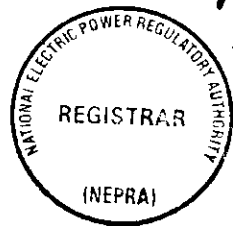
GENERATOR

Type	H2/Water Cooled
Rated output	210 MW, 247MVA
Rated Voltage	15.75 KV
Frequency/Speed	50 Hz/3000 RPM
Maximum Hydrogen Pressure	4.5 atm
Water Temp before gas coolers.	15 - 32 °C
Water Press Drop in Gas Coolers	2 kg/cm ²
Lubrication Oil Press.	0.5 - 1.0kg/cm ²
Gen. Gas Volume	56 m ³
Rotor Weight	42.5 Ton
Hydrogen Press	4 atm
Hydrogen Temp.	39 °C
Stator Current	9506 A
Max. Rotor Current	2330 A
Water Press in Gas Coolers.	4 kg/cm ²
Temperature of cold Condensate	30 - 40 °C
Max. Condensate Pressure	
Seal Oil-H2 Pressure Diff	3.5 kg/cm ²
Stator Weight	170 Ton
Max.H2 leakage for 12 Hrs.	0.1 kg/cm ²

THYRISTOR EXCITOR

Type	TEB 2500/1050H2/2TA	Boosting Voltage	650 V
Nominal Voltage	350 V	Boosting Current	5500 A
Nominal Current	3000 A	Boosting Duration	20 Sec.

V_{t2}



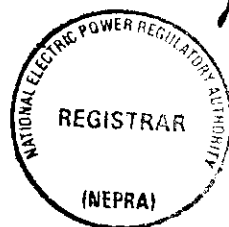
B – UNIT NO 4

TURBINE

MODE	N320-178/538
Type	Sub-Critical Intermediate – Reheat H.P & I.P Cylinders, Double Cylinder, Double Exhausters, Single- Shaft Reaction Condensate
Rated Power	320 MW
Rated Pressure of Main Steam	178 Bar (a)
Rated Pressure of Reheated Steam	34.5 bar (9a)
Rated Temperature of Reheated Steam	538 °C
Rated Back Pressure	0.071 bar
Cooling water Temperature	30 °C.
Rated Steam Flow	976.6 Tons/Hour
Speed	3000 RPM
Heat Consumption at Rated Condition	7870.5 KJ/KWH
Allowable Range for Frequency Variation	48.5-50.5 Hz
Start Up Time	Cold State about 3.7 Hours (Start to Synchronization). Hot State about 0.5 Hours (start to Synchronization)

BOILER

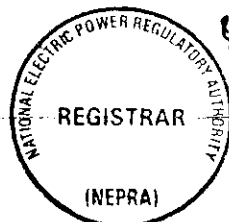
Mode	SG-1025/182.4 – YQ 839
Type	Subcriticalm Inter-mediate Reheat, Natural Circulation Steam Drum Boiler
Burning Mode	Micro- Positive Pressure Corner Firing
Fuel	Heavy Oil, Natural gas or Oil Gas Mixture
Total fuel Fired	Jeavu po 69 t/h (B-MCR)



Name	Unit	Rated Pressure			Slide Pressure
		B-MCR	80% T-MCR	60% T-MCR	60% T-MCR
Electric Load	MW	320			
Main Steam flow	T/H	1025	766.8	560.2	566.4
Superheater outlet press	BAR	182.4	182.4	182.4	130.0
Superheater Outlet Temp.	°C	541.0	541.0	441.0	541.0
Reheat Steam Flow	T/H	837.1	638.2	474.3	480.6
Reheater Inlet Pressure	BAR	38.95	29.3	21.6	21.8
Reheater Outlet Pressure	BAR	31.5	2738	20.5	20.7
Reheater Inlet Temp.	°C	325	302	282	313
Reheater Outlet Temp.	°C	541	541	541	541
Superheater Primary Spray Water flow.	T/H	0.0	2.9	19.0	65.2
Superheater Secondary Spray Water flow.	T/H	00	0.6	4.5	4.5
Feed Water Temp.	°C	182	262	244.4	246.4
Exhaust Gas Temp. (Uncorrected/corrected)	°C	164.4/160	156/152	152/148	155/150
Volumetric Heat Release Rate	GJ/m ³ h	911.6	713.6	524.54	548.16
Furnace Plant Heat Release Rate	GJ/m ³ h	20.1	15.45	11.81	12.04
Boiler Efficiency (Based on HHV)	%	589.29	89.69	89.21	88.92
Excess Air Ratio	%	5	5.0	5	5.0
Number of Nozzles in Service	LEV	4	4	3	2
Gas Re-Circulation Ratio	%	16.5	16.5	25.0	25.0

GENERATOR

Model	QFSN-320-2	Rated Voltage	20 KV
Rated Capacitance	376.4 KVA	Rated Current	10868 A
Active Power	320 MW	Rated Frequency	50 HZ
Reactive Power	198 MVAR	Rated Speed	3000 RPM
Power Factor	0.85 (Lag)	Rated Velocity	0.56
Efficiency	98.85% (at 320 MW)	Ratio of short circuit	3.1 bar
No-Load Exci. Current	113 V (75 °C)	Cool H ₂ Temperature	46 °C Range (40 °C – 48 °C)
Rated Exci. Current	987 A	H ₂ Temperature	<11.4 m ³ /d
Rated Exci. Current	2633 A	Generator Volume	63 m ³
Rated Exci. Voltage	317 V (90 °C)	Allowable Temp. Rise	64 °C



Input voltage	400/230 V		
Frequency	50+ 5% Hz	Intermediate DC circuit voltage	DC 230 V
Rated output power	100 KVA	Permitted Power factor	0.4 Lagging 0.9 leading
Power factor	0.8	Permitted air humidity	95% (no condensing)

DIESEL GENERATOR SET

DIESEL ENGINE

Rated output power	1064 KW	Rotating Speed	1000 RPM
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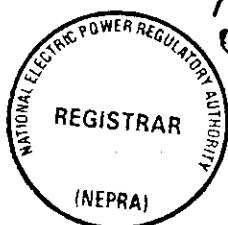
GENERATOR

Type	IFC 5.564-6TA 42	Rated current output	A.C. 1800 A
Rated power output	1000 KW	Power Factor	0.8
Rated voltage output	400 V	Frequency	50 Hz

C - UNIT NO. 5 & 6

BOILER

Type	HG-680/140-Y1
Manufacturer	Harbin Boiler Works
Live Steam Capacity at MCR	680 T/H
Design pressure	140 kg/cm ² g
Design Superheated Outlet Temp	541 °C
Design Reheater Outlet Temp	541 °C
Total Weight	4250 Ton
Feed Water Flow	680 Ton/H
Drum Pressure	155 Kg/cm ² g
Drum weight	114 Ton
Superheater outlet pressure	140 kg/cm ² g
Steam Boiler Efficiency	89.77 °C
Live Steam superheater out Temp	541 °C
Reheat Steam Inlet/Outlet Temp	26/24 kg/cm ²
Fuel Oil Consumption at Max. load	316/541 °C
F.D. Fan Air Flow	48400 kg/hr
I.D. Fan Gas Flow	58325 Nm ³ /hr
Flue Gas Temp. before air heater	307 °C
Flue Gas Temp. after air heater	145 °C (Min.)
Air Temp. before air heater	73 °C
Air Temp. after air heater	257 °C
F.W Temp. at Economizer inlet	25.8 °C



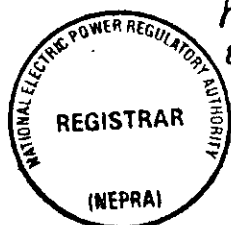
Type	Reheat condensing tandem compound double flow
Operating Speed	3000 RPM
Over Speed Trip	3300-3360 RPM
Output	204.544 MW
Turbine Generator heat Rate	2136.2 Kcal/KWH
Main Steam Pressure	131 kg/cm ² g
Steam Pressure RH	23.27 kg/cm ² g
Steam Temp. Main Steam	538 °C
Steam Temp. RH Steam	538 °C
Steam Flow Main Steam	680 T/H
Steam Flow RH Steam	579.34 T/H
No load Steam Consumption	36 Ton/Hr
Feed water final Temp.	250.8 °C
Exhaust Steam Pressure	132 mm Hg (a)
Exhaust Steam Flow	460.92 Ton /Hr

GENERATOR

Type	QFSN-210-2
Capacity (Power)	247000 KVA
Rated Frequency	50 Hz
Rated voltage	15.75+5% Kv
Rated Current	9.056 KA
Speed	3000 RPM
Power Factor	0.85
Field Voltage (No load)	169 V
Field Voltage (Peak load 0.85 p.f)	470 V
Field Current (Peak load 0.85 p.f)	1830 A
Hydrogen gas pressure	3 kg/cm ² g
Hydrogen gas consumption	14.6 m ³ /day
Cooling water pressure	2 kg/cm ² g
Stator winding Temp.	120 °C
Rotor winding Temp.	120 °C

EXCITER

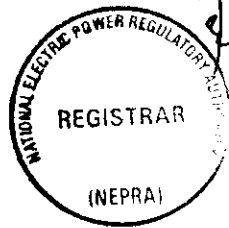
Description	Main Exciter	Pilot Exciter
Excitation Method	A.C. Exciter	A.C Exciter
Output	1165 KW	46 KW
Voltage	4341 V	161/93 V
Continuous Current	1562 A	165/285.8 A
Short time Current	3124 A	-
Power Factor	0.91	0.875
Frequency	100 Hz	500 Hz



SECTION - B

SPS FAISALABAD

V-2



INFORMATION AS PER SCHEDULE- III (REGULATION 3 (6))

STEAM POWER STATION FAISALABAD

1. Location and Site map.

This Power Station is situated at 10 Km from Faisalabad city on Faisalabad-Sheikhpura road. Nishatabad railway station is 04 Km in the West and Rakh Branch Canal flows close to the power station in the East.

Attached as Annexure A.

2. Technology and No. of Units.

There are two conventional steam power generating units installed and are in operation at Steam Power Station Faisalabad. Total capacity of these units is 132 MW (Two identical unit each of 66 MW). Main contractor was M/s Westing-House USA.

Attached at Annexure – B-1, B-2.

3. Fuel Type imported/indigenous, Amount, Suppliers, Logistics, Pipeline etc.

Main Fuel is natural Gas which is being supplied by NGPL (indigenous) through pipeline. Standby fuel is furnace oil which is being supplied by Pakistan State Oil through Railway Wagons (Imported).

4. Emission Values.

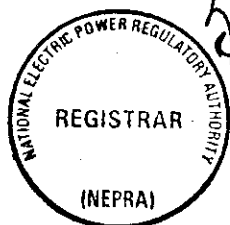
Attached at Annexure - C.

5. Cooling Water Source Tube wells, Sea/River/Canal.

Canal water & Tube well water

Six tube wells were installed originally at the time of erection with the passage of time, the characteristic of deep well water had undergone significant change. As a result more tube wells had to be added to the existing system from time to time. At present eight (8) tube wells are in working order.

No. of Tube Wells	Power H.P	Capacity G.P.M	Head
1	50	850	215
2	50	850	215
4	60	850	200
9	60	850	200
10	60	850	200
13	60	850	200
14	50	850	200
15	50	850	200



6. Inter-Connection with National Grid, Company, Distance and name of the Grid.

Connected with 220 KV Nishatabad Grid Station about 02 KM from Power Station (Single line diagram is attached as Annexure-D).

7. Installed Capacity, Derated capacity, Expected remaining life.

Unit No.	Installed Capacity (MW)	Derated Capacity (MW)	Expected Remaining Life (Years)
1	66	50	10
2	66	50	10

8. Due Diligence Report.

It is enclosed separately.

9. Rehabilitation Plans, Previous Rehabilitation Programme.

Rehabilitation of Boilers and Cooling towers is under way and expected to be completed within 1999-2000.
Details are attached as Annexure – E & E-1.

10. Operational Record including environment monitoring data for last five years.

Enclosed as Annexure – F, F-1.

11. Steam Power Station Plant Characteristics.

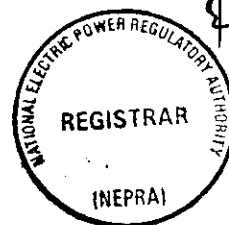
Steam Pressure	1250 PSI
Steam Temperature	950 + 10° F
Steam Flow at full load	600000/· lbs/hr
Generation Voltage	11 KV
Frequency	50 HZ
Power factor	0.85
Automatic generation Control	Nil
Ramping Rate	01 MW/min
Auxiliary Consumption at full load	0.170 MW
Alternative fuel	Furnace Oil
Time Required to synchronized to grid from cold condition	06 Hours

12. Training and Development.

Training at local training centers of WAPDA at :

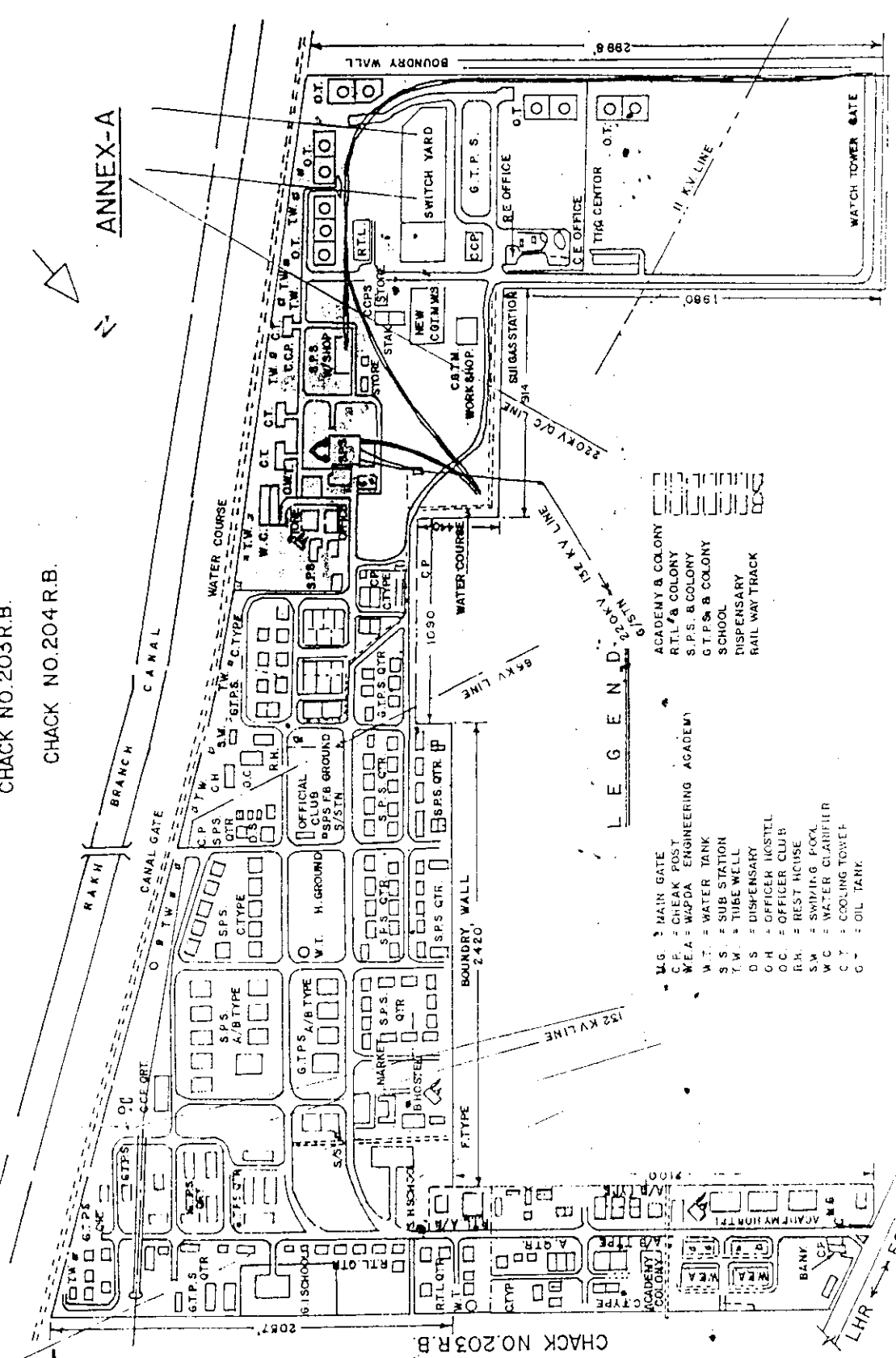
- a) NGPS Multan and
- b) Thermal Power Station Muzaffargarh.

V



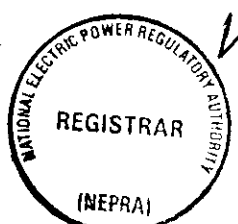
A B A D I (MALIK PUR)
CHACK NO.203R.B.

CHACK NO.204R.B.



- LEGEND**
- U.G. = MAIN GATE
 - C.P. = CHECK POST
 - W.E.A. = WAPDA ENGINEERING ACADEMY
 - W.T. = WATER TANK
 - S.S. = SUB STATION
 - T.W. = TUBE WELL
 - D.S. = DISPENSARY
 - O.H. = OFFICER HOSTEL
 - O.C. = OFFICER CLUB
 - R.H. = REST HOUSE
 - S.W. = SWIMMING POOL
 - W.C. = WATER CLARIFIER
 - C.T. = COOLING TOWER
 - O. = OIL TANK
- ACADEMY B COLONY
 - RTL/A COLONY
 - S.P.S. B COLONY
 - G.T.P.S. B COLONY
 - SCHOOL
 - DISPENSARY
 - RAIL WAY TRACK

A B A D I (MANAWALA)
CHACK NO.203R.B.

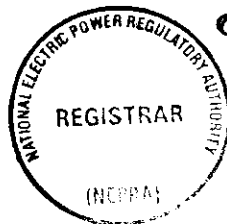


BRIEF DESCRIPTION OF EQUIPMENT

BOILER

Make	Foster Wheeler Corporation U.S.A.
Type	Water Tube
Capacity	600,000 pounds of Steam per Hour
Design Pressure	1470 Psig.
Super Heater outlet Pressure	1250 Psig.
Super Heater Outlet Temperature	950 + 10 Fo
No. of Burners per boiler	8 (Gas or Oil)
No. of F.D. Fan per Boiler	1

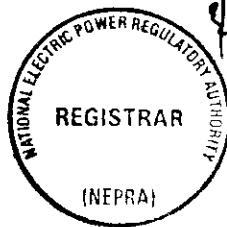
V⁺2



TURBINE

Make	Westinghouse, U.S.A
Serial No.	13A3013-1&2
Type	Reaction Condensing
Capacity	66.000 KW
Speed	3,000 R.P.M
Steam Inlet Pressure	1250 Psig.
Steam Inlet Temperature	950 Fo
L.P Turbine Exhaust Pressure	3.5" Hg. Abs.
Extraction & Operation Blading	Feed Water Heating 5 stages.

Vtz



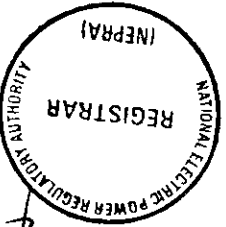
STEAM POWER STATION FAISALABAD

Emissions Data July 1995 to June 2000

Year	Fuel Consumption			Emissions												Total Emissions						
	F.O Tons	HSD Ltrs	Gas MMCF	On F.O (Tons)						On Gas (Tons)			On HSD (Tons)			Tons/Year			Tons/Day			
				SOx	NOx	PM	CO2	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2				
95-96	134152	90000	1296	7378	1503	402	418107	95	2.9	74723	1	0	0	192	7380	1598	405	492830	20	4	1	1350
96-97	69459	70000	2420	3820	778	208	216481	178	6	139529	1	0	0	149	3821	956	214	356010	10	3	1	975
97-98	9682	50000	409	533	108	29	30176	30	1	23582	1	0	0	107	533	138	30	53757	1	0	0	147
98-99	7103	20000	667	391	80	21	22138	49	2	38457	0	0	0	43	391	129	23	60595	1	0	0	166
99-00	6093	10000	3059	335	68	18	18990	225	7	176372	0	0	0	21	335	293	25	195362	1	1	0	535

SOx Emissions Standards

WHO Standards	235 Tons/Day
Pakistan Standards	500 Tons/Day
World Bank Standards	500 Tons/Day



STEAM POWER STATION FAISALABAD
AVERAGE WASTE WATER ANALYSIS DATA JULY 1995 TO JUNE 2000

Year	Temp. °C	pH	Total Dissolved Solids	Suspended Solids	Chemical Oxygen Demand	BOD	Nil	Sulphate	Chlorine
			ppm	ppm	ppm	ppm	ppm	ppm	ppm
1995 - 1996	36.5	7.8	739	85	15	4.5	NA	450	0.2
1996 - 1997	35.5	8.6	840	125	10.5	6.5	Nil	350	0.03
1997 - 1998	37	8.5	1025	115	26	65	Nil	435	0.05
1998 - 1999	34	8.9	985	98	85	70	Nil	465	0.5
1999 - 2000	34.5	8.6	895	92	56	75	Nil	461	0.5





SECTION - C
GTPS FAISALABAD

GAS TURBINE POWER STATION FAISALABAD

1. Location (Location Map, Site Map).
This Power Station is situated at 10 Kilometer. from Faisalabad city on Faisalabad Sheikhupura Road. Nishatabad Railway Station is 4 Kilometer in the West and Rakh Branch Canal flow close to the power station in the East.
Attached as Annexure - A.
2. Technology, Number of Units.
Power Station comprises of 8 X 25 MW Gas Turbines of AEG KANIS Germany and one combine cycle Unit of 44 MW from Harbin Turbine Works China.
Attached as Annexure – B-1, B-2.
3. Fuel Type, imported / indigenous, Amount, Supplier, Logistics, Pipeline etc.
Natural Gas Supplied by M/s SNGPL through pipeline.
HSD Oil Having storage capacity of about 1515000 Liters, with Railway or Road Tankers decanting facility.
4. Emission Values.
Attached as Annexure-C
5. Cooling Water Source, Tube Wells, Sea/ River/Canal.
Cooling water is taken from Rakh Branch Canal. During the closure of canal water is taken from tubewells.
6. Inter-Connection with National Grid.
This Station is connected via 4 Transmission Lines of 132 KV with the 220 KV Nishatabad, 220 KV Jaranwala Road and 132 KV Old Thermal Grid Stations. The 220 KV Nishatabad grid station is located about 2 KM away from this power station.
Single line diagram is attached as Annexure-D.



Unit No.9(CC)	Unit No.8	Unit 1-7	Unit No.9
44	25	25	44
38	19	19	38
10	10	10	10

8. Due diligence report is enclosed separately

9. Rehabilitation plans, previous rehabilitation programme.

Attached as Annexure-E.

10. Operational Record including environment monitoring data for last five years.

Environment record from January to October 2000 is attached as Annexure - F, F-1.

11. Project Cost, Information regarding sources and amounts of equity and debt.

Local (Million)	Foreign (Million)	Loan
-	DM = 74,000	Unit No.1 - 8
Rs.115.265	US\$ = 23,648 BFF = 428,992	Unit No.9

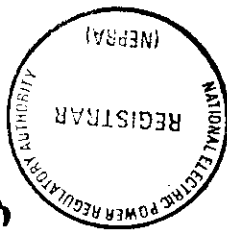
12. Plant Characteristics

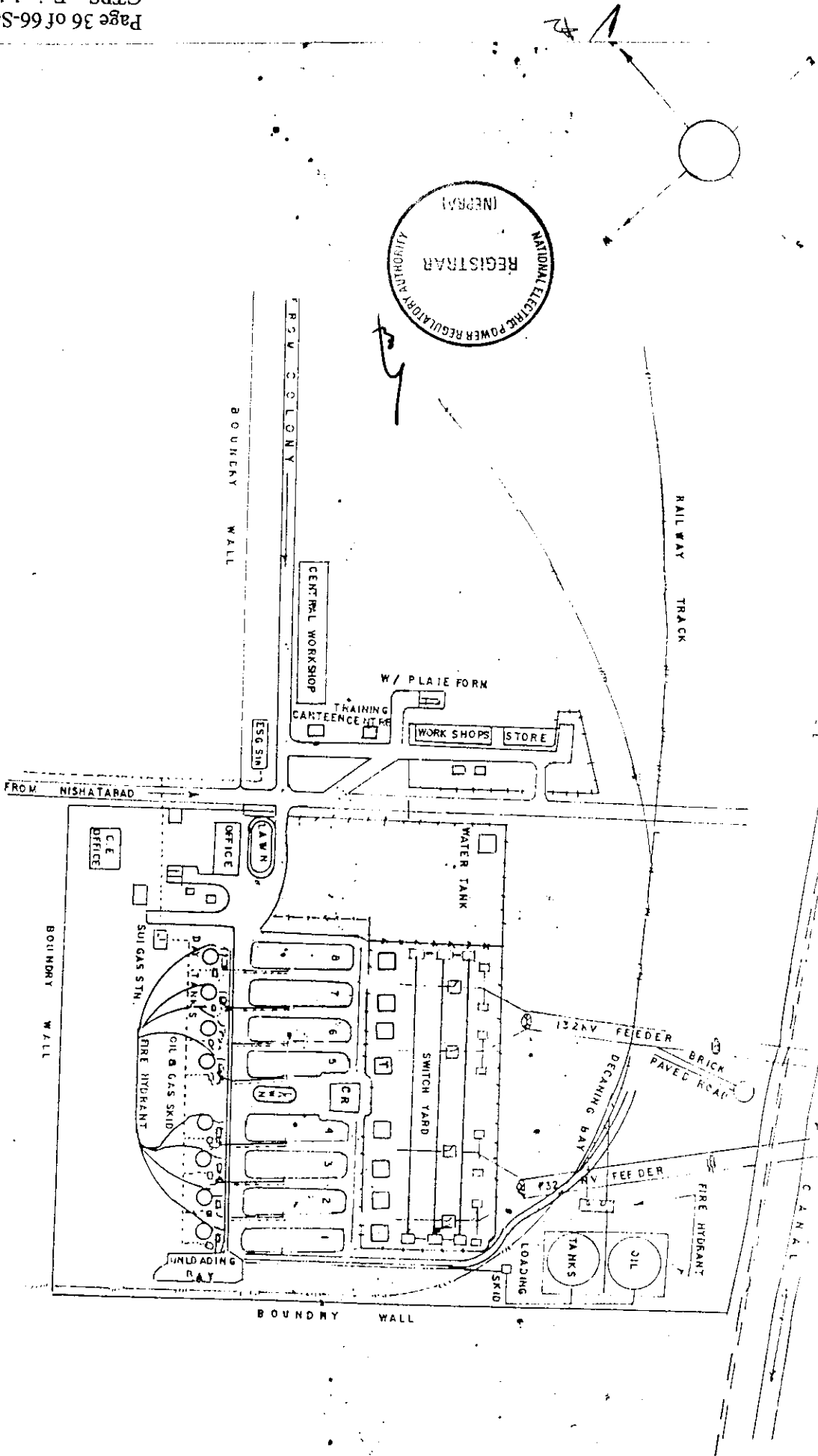
Generation Voltage	10.5 KV
Frequency	50 HZ
Power Factor	0.8
Ramping Rate	1 MW/min.
Alternative fuel	HSD Oil
Auxiliary Consumption	Unit No.1-8 Less than 1%
	Unit No. 9 Less than 6%
	Unit No.1-8 about 5-8 min.
	Unit No.9 about 4 hours.

Time required to synchronize to grid.

13. Training and Development.

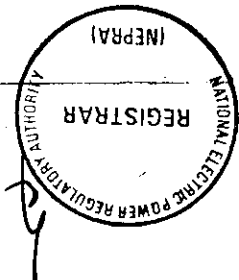
A training center under the supervision of Director Training has the facilities for the Operation and Maintenance training of Engineers and staff.





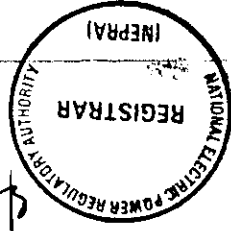
TECHNICAL SPECIFICATIONS GAS TURBINE POWER STATION

TURBINES (8 Nos.)	
Capacity	25 MW (each)
Make	AEG-KANIS Germany
Type	Impulse
Speed	5100 R.P.M.
No. of Stages	2
Inlet Pressure	1.003 Kg/cm ²
Inlet Temperature	15°C
Exhaust Temperature	483°C
Type of Fuel	Natural Gas/HSD Oil
Nos. of Combustors	10
Average Overall Efficiency	27%
Lube Oil	Gulf Crest 44
Capacity	32000 KVA
Make	AEG-KANIS Germany
Generating Voltage	10.5 KV
Max. Current	1760 Amps.
Excitation Voltage	140 V
Excitation Current	540 Amps.
Power Factor	0.8
Speed	3000 R.P.M.
Type of Cooling	Air-cooled
Grounding	Resistance Grounded
GENERATOR TRANSFORMER (8 NOS.)	
Make	VOLTA VERKE West Germany
Capacity	28 MVA
Voltage Rating	11/132 KV
Vector Group	Ynd 11
No. of load taps	5
Type of Cooling	Natural Air Cooled



44 MW COMBINED CYCLE PLANT

TURBINE	
Capacity	47000 KW
Make	Harbin Turbine Works of China
Type	Impulse/Condensing
No. of Stages	18
Speed	3000 R.P.M.
Inlet Pressure	39.5 bar
Exhaust Pressure	0.1 bar
Steam/Flow Rate	171 Tons/hour
Inlet Temperature	475°C
GENERATOR	
Capacity	62500 KVA
Make	Harbin Electrical Equipment Work China
Generating Voltage	11 KV
Excitation Voltage	270 V
Excitation Current	530 Amps.
Max. Current	3280 Amps.
Power Factor	0.8
Speed	3000 R.P.M.
Type of Cooling	Hydrogen cooled
Hydrogen Pressure	1.0 bar
Hydrogen Purity	>95%
HRSGs (4 Nos.)	
Capacity	42.7 Tons/hour
Type	Coil Finned
Make	Cockril Mechanical Industries Belgium
Steam Pressure	43.35 bar
Steam Temperature	480°C
Inlet Gas Temperature	499°C
Outlet Gas Temperature	200°C
MAIN TRANSFORMER	
Make	SHENYANG T/F WORKS CHINA
Capacity	63000 KVA
Voltage Ratio	141 + 9 x 1.39% 11 KV
Vector Group	YN,d II
Type of Cooling	ONAN/ONAF 75/100%



Annexure - C

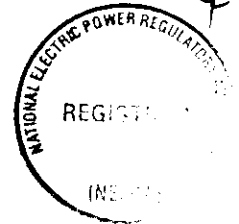
GAS TURBINE POWER STATION FAISALABAD

Emissions Data July 1995 to June 2000

Year	Fuel Consumption			Emissions												Total Emissions									
	F.O Tons	HSD M Ltrs	Gas MMCFT	On F.O (Tons)				On Gas (Tons)				On HSD (Tons)				Tons/Year					Tons/Day				
				SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2		
1995-96	0	81.36	2252	0	0	0	0	166	5.1	129843	1339	750	293	173345	1339	166	5	129843	4	0	0	356			
1996-97	0	20.49	1759	0	0	0	0	129	4	101418	337	189	74	43656	337	129	4	101418	1	0	0	278			
1997-98	0	0.01	2222	0	0	0	0	163	5	128113	0	0	0	21	0	163	5	128113	0	0	0	351			
1998-99	400	5.35	4201	22	4	1	1247	309	10	242216	88	49	19	11399	110	313	11	243462	0	1	0	667			
1999-00	0	0.01	5921	0	0	0	0	435	13	341385	0	0	0	21	0	435	13	341385	0	1	0	935			

SOx Emissions Standards

WHO Standards 235 Tons/Day
Pakistan Standards 500 Tons/Day
World Bank Standards 500 Tons/Day



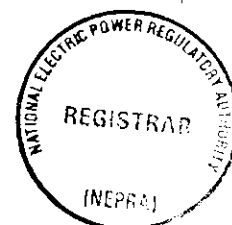
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Annexure - F-1

GAS TURBINE POWER STATION FAISALABAD

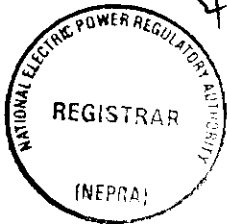
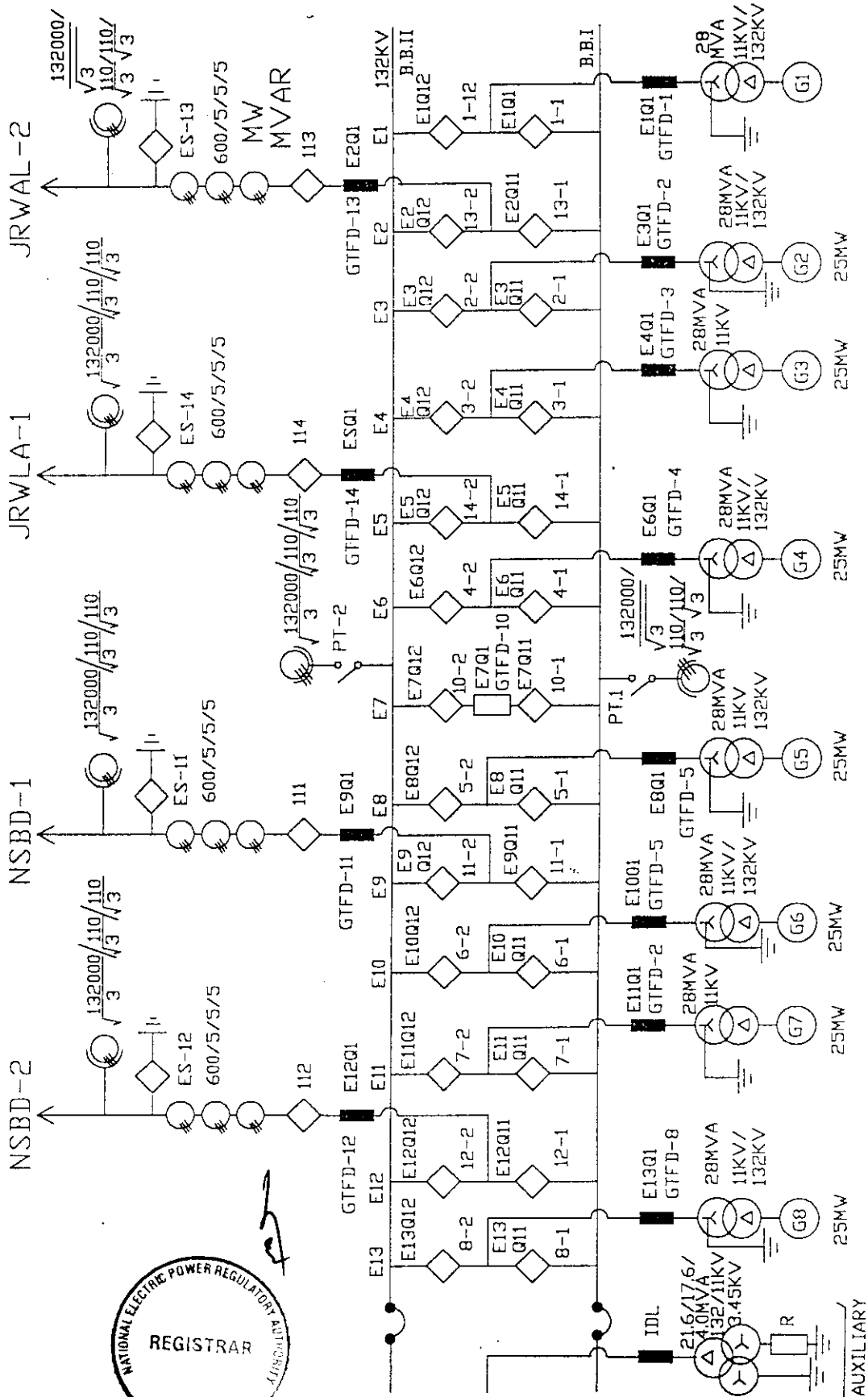
AVERAGE WASTE WATER ANALYSIS DATA JULY 1995 TO JUNE 2000

Year	Temp. °C	pH	Total Dissolved Solids		Suspended Solids	Chemical Oxygen Demand		BOD	Oil	Sulphate		Chlorine	
			ppm	ppm		ppm	ppm			ppm	ppm	ppm	ppm
1995 - 1996	36.5	7.8	739	85	15	4.5	NA	450	0.2				
1996 - 1997	35.5	8.6	840	125	10.5	6.5	Nil	350	0.03				
1997 - 1998	37	8.5	1025	115	26	65	Nil	435	0.05				
1998 - 1999	34	8.9	985	98	85	70	Nil	465	0.5				
1999 - 2000	34.5	8.6	895	92	56	75	Nil	461	0.5				



ANNEXURE-D

132KV GRID STATION G.T.P.S. FAISALABAD

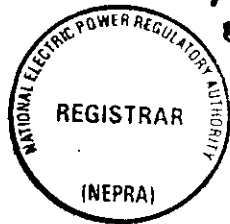


17

SECTION - D

NGPS MULTAN

V R



6. Interconnection with National Grid Company, distance and name of the grid, voltage level

<u>Name</u>	<u>Distance</u>
132 KV Grid Khanewal Road	10 K.M

Details are attached as Annexure - D.

7. Installed capacity, Derated capacity, Expected remaining life

Unit No.	Installed Capacity *	Derated capacity	Remaining Life
1.	65	50	5
3.	65	50	5
4.	65	50	5

* Unit No. 2 is out of operation due to cracks at the high pressure turbine casing of and is un-operative since 17.09.1995. As per Authority decision its major parts i.e. H.P. Rotor/6 K.V. Motors have been cannibalized on other units and hence remains redundant.

8. Due Diligence Report.

Enclosed separately.

9. Rehabilitation plans, previous rehabilitation programme.

As per Annexure-E.

10. Operational record including environment monitoring data for last five years.

Attached as Annexure-F-1,F-2.

11. Project Cost, Information regarding sources and amounts of equity and debt

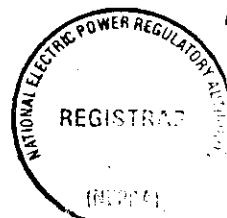
Loan	Total Cost (Rs. Million)
Unit No.1 - 2	118
Unit No.3 - 4	136

12. Plant Characteristics

Generation Voltage	11 KV.
Frequency	50 C/S
Power Factor	0.8
Ramping Rate	2 MW/Minutes
Alternative fuel	Nil
Auxiliary Consumption	8 to 10% depending on load
Time required to synchronize to grid.	10 to 20 Minutes

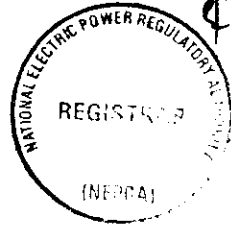
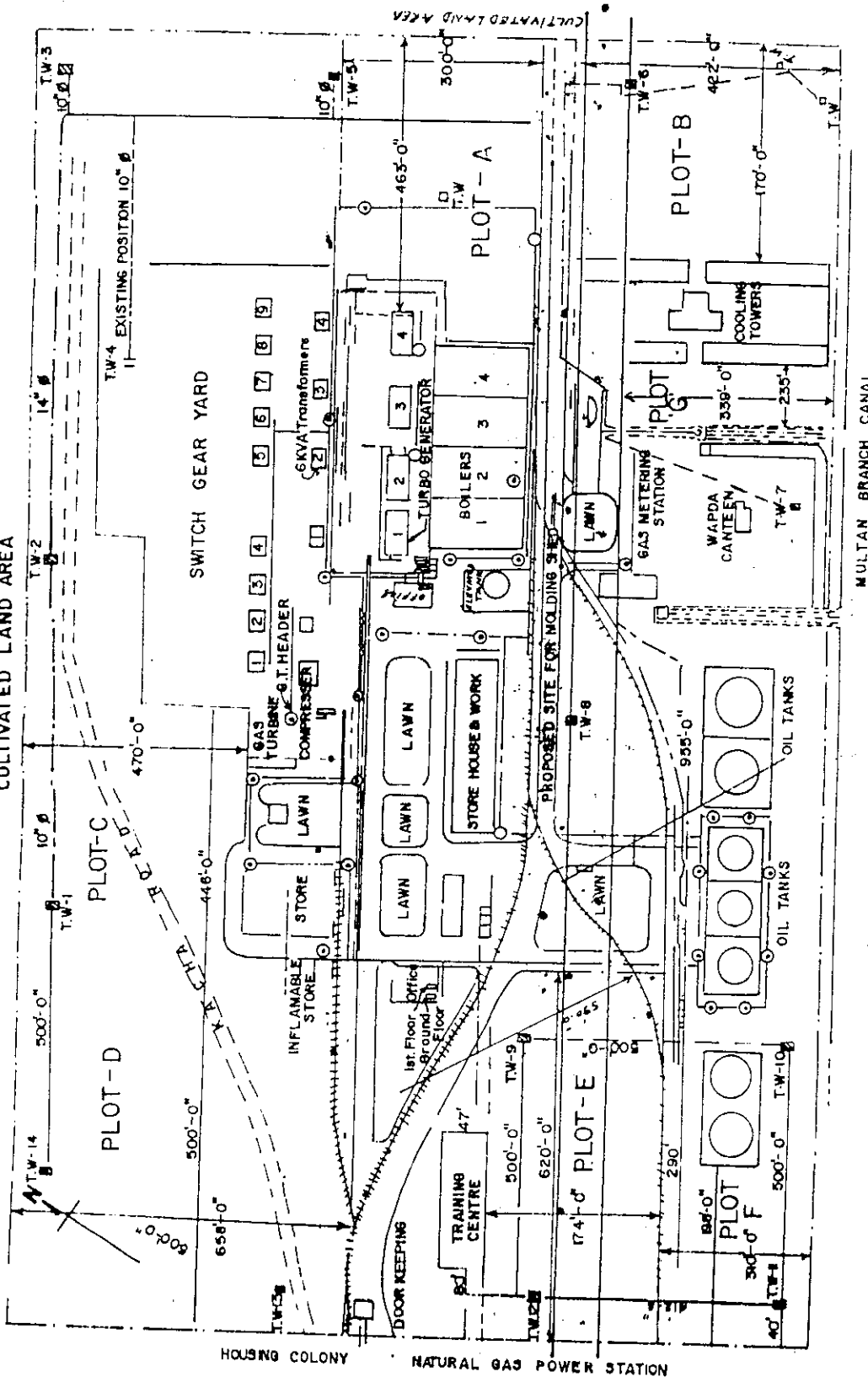
13. Training and Development

1. Training Center TPS Muzaffargarh.
2. WAPDA Engineering Academy Faisalabad.



ANNEXURE - AI

SITE PLAN OF KEY POINT NO.1183
NATURAL GAS POWER STATION WAPDA MULTAN CATEGOREY IA
CULTIVATED LAND AREA



PLOT - A :-	466'x 300' = 142.63m x 91.43m
PLOT - B :-	170'x 422' = 51.21m x 128.61m
PLOT - C :-	446'x 470' = 136.93m x 143.24m
PLOT - D :-	600'x 658' = 182.87m x 200.54m
PLOT - E :-	620'x 174' = 188.96m x 53.03m
PLOT - F :-	196'x 310' = 60.34 x 94.48m
PLOT - G :-	235'x 335' = 71.62m x 103.35m

BOILERS

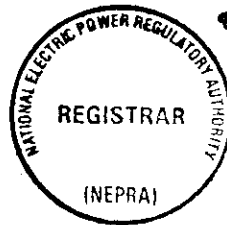
Make

L & C Steinmuller Gummersbach West Germany

Licensed Pressure.	1564 Psig
Steam Pressure super-heater outlet	1320 Psig
Superheated steam temperature Maximum.	959 °F
Superheated steam temperature normal.	950 °F
Steam out put Maximum Load.	270 Tons/Hours
Steam out put economical load	225 Tons/Hours

The boilers are water tube, natural circulation, balanced draft and radiant type. Normally Natural Gas (Sui Gas) is used as fuel. In case natural gas is not available, provision also exists to used the Furnace oil.

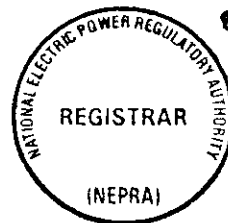
Latent heat in the fuel is released by combustion in the boiler furnace. The furnace temperature is increased upto 2700 °F. The flue gases thus produced pass through radiation super-heaters, vertical super-heaters, horizontal super-heaters, economizer, air pre-heaters and finally induced out through chimney at 280 °F.



TURBINE DATA

Make	AEG. West Germany
Out put maximum	65,000 K.W
Out put economical	52,000 K.W
Live steam pressure normal	1,250 Psig
Live steam pressure maximum	1,310 Psig
Live steam pressure normal	950 °F
Live steam temperature maximum	959 °F
Exhaust pressure normal	1.68' Hg.abs
Operating speed	3000 rpm
Critical speed	1200 rpm
No. of steam extractions	5

V 72



Annexure - C

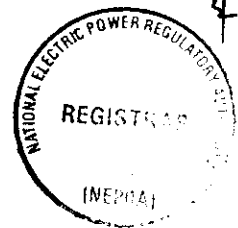
NATURAL GAS POWER STATION MULTAN

Emissions Data July 1995 to June 2000

Year	Fuel Consumption			Emissions												Total Emissions									
	F.O (Tons)	HSD (Ltrs)	Gas MMCFT	On F.O (Tons)				On Gas (Tons)				On HSD (Tons)				Ton/Year				Ton/Day					
				SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2	SOx	NOx	PM	CO2		
1995-96	184390	0	2511	10141	2065	553	574682	185	5.7	144776	0	0	0	0	0	0	0	10141	2250	559	719458	28	6	2	1971
1996-97	139572	0	5309	7676	1563	419	434999	390	12	306099	0	0	0	0	0	0	0	7676	1953	431	741099	21	5	1	2030
1997-98	79665	0	5060	4382	892	239	248289	372	12	291743	0	0	0	0	0	0	0	4382	1264	250	540032	12	3	1	1480
1998-99	30889	0	3220	1699	346	93	96271	237	7	185654	0	0	0	0	0	0	0	1699	583	100	281925	5	2	0	772
1999-00	10924	0	4223	601	122	33	34046	310	10	243484	0	0	0	0	0	0	0	601	433	42	277531	2	1	0	760

SOx Emissions Standards

WHO Standards	235 Tons/Day
Pakistan Standards	500 Tons/Day
World Bank Standards	500 Tons/Day

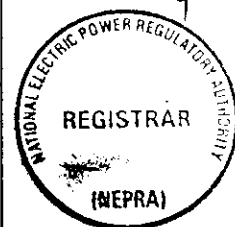


Annexure-F-2

NATURAL GAS POWER STATION MULTAN

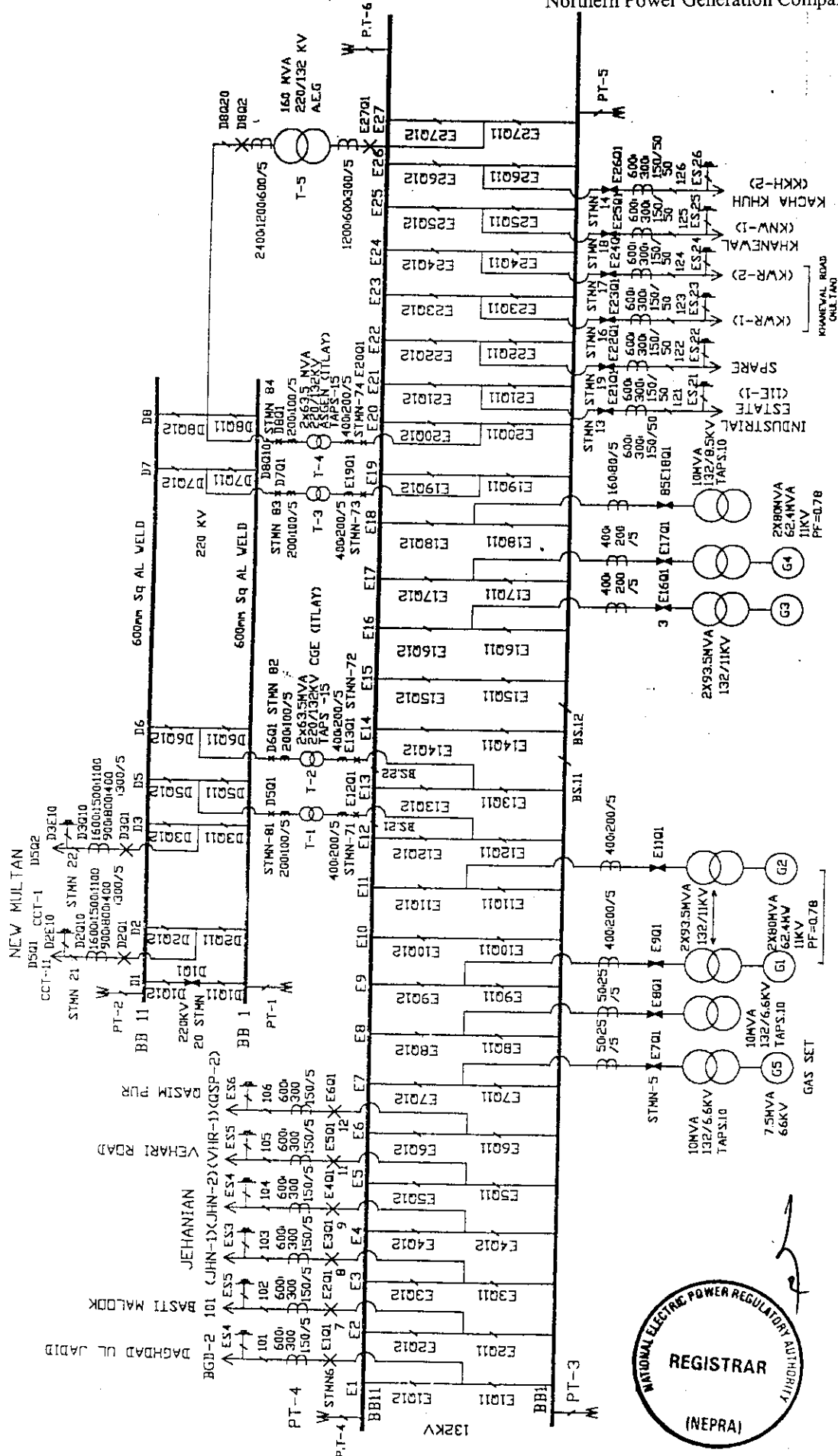
AVERAGE WASTE WATER ANALYSIS DATA JULY 1995 TO JUNE 2000

Month	Qty of water produced M. Ton	Tem. °C	pH	C.O.D. ppm	Chlorine ppm	Chloride ppm	Sulphate ppm	T.T.S		T.D.S	
								ppm	ppm	ppm	ppm
1995 - 1996	158.5	28.6	8.9	145	0.5	91.5	435	6.6		1340.5	
1996 - 1997	157	29.4	8.5	135	0.48	95	459	7.9		1495	
1997 - 1998	171.5	32.8	7.65	148	Nil	107	560	23.0		1560	
1998 - 1999	185.9	30.4	7.80	151	Nil	90	500	26.0		1615	
1999 - 2000	170	31.3	7.72	149	0.6	123	570	Nil		1402	



ANNEXURE - D

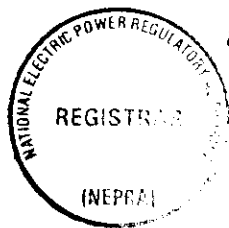
220/132KV GRID STATION
N.G.P.S MULTAN



Handwritten mark resembling 'V+2'.

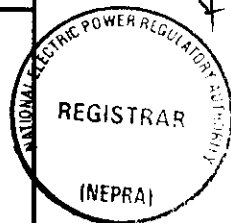
GENERATION PERFORMANCE INDICATORS

✓ +2



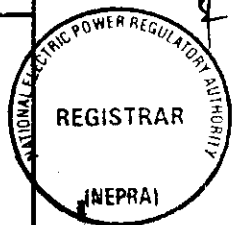
JULY 1999

S/N	POWER STATIONS	PERFORMANCE INDICATORS										Thermal Efficiency %
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh			
1	TPS M'garh	1350	1350	732	71.74	38.90	67.10	54.22	10814	31.56		
2	SPS Faisalabad	132	100	45	62.37	28.06	73.03	34.09	13977	24.42		
3	GTPS Faisalabad	244	190	159	27.18	22.74	79.46	65.16	11219	30.42		
4	NGPS Multan	195	140	80	74.38	42.50	74.38	41.03	14908	22.89		
	GENCO-III	1921	1780	1016	64.56	36.85	69.33	52.89	11357	30.36		



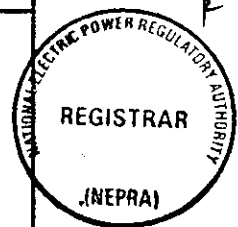
AUGUST 1999

S/N	POWER STATIONS	PERFORMANCE INDICATORS									
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh	Thermal Efficiency %	
1	TPS M'garh	1350	1350	815	63.02	38.04	59.57	60.37	10407	32.79	
2	SPS Faisalabad	132	100	45	17.98	8.09	21.53	34.09	13577	25.14	
3	GTPS Faisalabad	244	190	120	6.94	4.38	68.71	49.18	18195	18.76	
4	NGPS Multan	195	140	80	66.73	38.13	66.73	41.03	14078	24.24	
	GENCO-III	1921	1780	1060	55.04	32.77	58.97	55.18	11705	30.19	



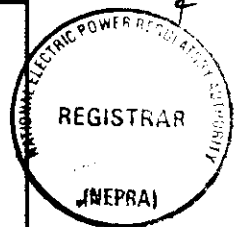
SEPTEMBER 1999

S/N	POWER STATIONS	PERFORMANCE INDICATORS									
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh	Thermal Efficiency %	
1	TPS M'garh	1350	1350	789	79.44	46.43	72.86	58.44	9969	34.23	
2	SPS Faisalabad	132	100	45	7.56	3.40	11.16	34.09	14225	23.99	
3	GTPS Faisalabad	244	190	158	29.13	24.22	77.02	64.75	12126	28.14	
4	NGPS Multan	195	140	80	75.97	43.41	75.97	41.03	14571	23.42	
	GENCO-III	1921	1780	1072	68.75	41.40	70.08	55.80	10801	32.16	



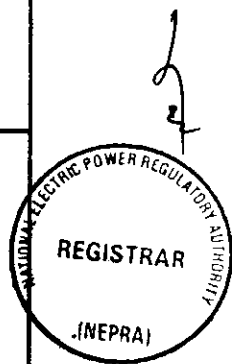
OCTOBER 1999

S/N	POWER STATIONS	PERFORMANCE INDICATORS									
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh	Thermal Efficiency %	
1	TPS M'garh	1350	1350	780	72.82	42.07	57.25	57.78	9668	35.30	
2	SPS Faisalabad	132	100	45	51.49	23.17	58.15	34.09	14333	23.81	
3	GTPS Faisalabad	244	190	149	26.80	21.01	86.01	61.07	11008	31.00	
4	NGPS Multan	195	140	80	60.37	34.50	60.37	41.03	14185	24.06	
	GENCO-III	1921	1780	1054	64.45	38.17	60.62	54.87	10428	33.31	



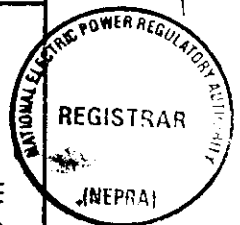
NOVEMBER 1999

S/N	POWER STATIONS	PERFORMANCE INDICATORS									
		Total Installed Capacity	Derated Capacity	Max. Load	Load Factor	Plant Utilization Factor	Plant Availability Factor	Plant Capacity Factor	Gross Heat Rate	Thermal Efficiency	
		MW	MW	MW	%	%	%	%	Btu/kWh	%	
1	TPS M'garh	1350	1350	515	36.53	13.93	83.86	38.15	11021	30.97	
2	SPS Faisalabad	132	100	45	37.31	16.79	13.09	34.09	13412	25.45	
3	GTPS Faisalabad	244	190	152	6.16	4.93	96.31	62.30	17334	19.69	
4	NGPS Multan	195	140	80	31.65	18.09	57.44	41.03	13935	24.49	
	GENCO-III	1921	1780	792	30.25	13.46	79.14	41.23	12058	28.94	



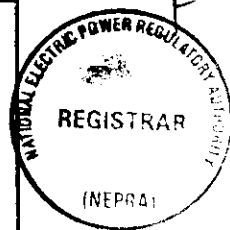
DECEMBER 1999

S/N	POWER STATIONS	PERFORMANCE INDICATORS										Thermal Efficiency %
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh			
1	TPS M'garh	1350	1350	1075	41.73	33.23	83.86	79.63	9919	34.41		
2	SPS Faisalabad	132	100	0	-	0.00	13.09	0.00	0	0.00		
3	GTPS Faisalabad	244	190	183	17.75	17.09	96.31	75.00	11992	28.46		
4	NGPS Multan	195	140	0	-	0.00	57.44	0.00	0	0.00		
	GENCO-III	1921	1780	1258	38.24	27.03	79.14	65.49	8803	29.13		



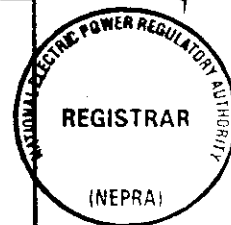
JANUARY 2000

S/N	POWER STATIONS	PERFORMANCE INDICATORS										Thermal Efficiency %
		Total Installed Capacity	Derated Capacity	Max. Load	Load Factor	Plant Utilization Factor	Plant Availability Factor	Plant Capacity Factor	Gross Heat Rate	Thermal Efficiency %		
		MW	MW	MW	%	%	%	%	Btu/kWh			
1	TPS M'garh	1350	1350	1115	63.63	52.55	83.86	82.59	9937	34.35		
2	SPS Faisalabad	132	100	30	0.99	0.30	13.09	22.73	13758	24.81		
3	GTPS Faisalabad	244	190	176	8.37	7.75	96.31	72.13	14756	23.13		
4	NGPS Multan	195	140	80	57.44	32.82	57.44	41.03	14299	23.87		
	GENCO-III	1921	1780	1401	54.99	43.28	79.14	72.93	11009	31.79		



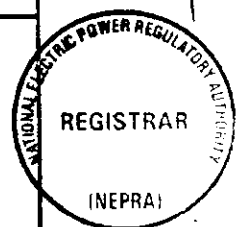
FEBRUARY 2000

S/N	POWER STATIONS	PERFORMANCE INDICATORS									
		Total Installed Capacity MW	Derated Capab- ility MW	Max. Load MW	Load Factor %	Plant Ut'zation Factor %	Plant Avail'ty Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh	Thermal Effeci- ency %	
1	TPS M'garh	1350	1350	940	62.89	43.79	95.36	69.63	9967	34.24	
2	SPS Faisalabad	132	100	30	3.45	1.03	47.65	22.73	13140	25.97	
3	GTPS Faisalabad	244	190	159	5.05	4.23	100.00	65.16	18084	18.87	
4	NGPS Multan	195	140	0	-	0.04	0.00	0.00	46523	7.34	
	GENCO-III	1921	1780	1129	53.17	33.72	85.67	58.77	13887	30.02	



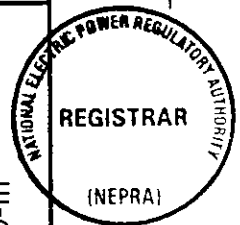
MARCH 2000

S/N	POWER STATIONS	PERFORMANCE INDICATORS									
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh	Thermal Efficiency %	
1	TPS M'garh	1350	1350	1005	76.45	56.91	79.02	74.44	10531	32.41	
2	SPS Faisalabad	132	100	90	44.56	40.11	73.20	68.18	13963	24.44	
3	GTPS Faisalabad	244	190	165	38.58	33.50	88.38	67.62	17751	19.23	
4	NGPS Multan	195	140	75	37.37	20.02	37.37	38.46	13970	24.43	
	GENCO-III	1921	1780	1335	67.43	50.57	76.42	69.50	11765	29.92	



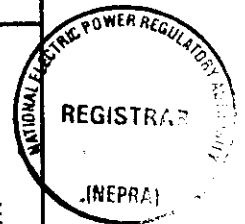
APRIL 2000

S/N	POWER STATIONS	PERFORMANCE INDICATORS									
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh	Thermal Efficiency %	
1	TPS M'garh	1350	1350	1005	83.36	62.06	80.98	74.44	10253	33.29	
2	SPS Faisalabad	132	100	97	71.92	69.76	95.11	73.48	13488	25.30	
3	GTPS Faisalabad	244	190	192	63.56	64.23	87.25	78.69	16706	20.43	
4	NGPS Multan	195	140	70	60.89	30.44	60.89	35.90	13802	24.73	
	GENCO-III	1921	1780	1364	78.61	60.24	80.86	71.00	11403	30.79	



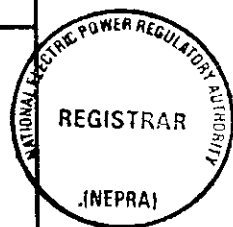
MAY 2000

SIN	POWER STATIONS	PERFORMANCE INDICATORS									
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh	Thermal Efficiency %	
1	TPS M'garh	1350	1350	1110	65.25	53.65	74.82	82.22	11269	30.29	
2	SPS Faisalabad	132	100	75	86.42	64.81	89.42	56.82	13295	25.67	
3	GTPS Faisalabad	244	190	172	47.77	43.25	93.69	70.49	14203	24.03	
4	NGPS Multan	195	140	60	66.12	28.34	66.12	30.77	14180	24.07	
	GENCO-III	1921	1780	1417	64.29	51.18	76.97	73.76	11925	28.87	



JUNE 2000

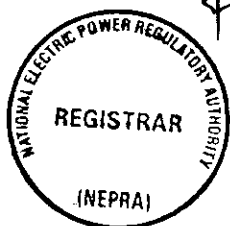
S/N	POWER STATIONS	PERFORMANCE INDICATORS										Thermal Efficiency %
		Total Installed Capacity MW	Derated Capacity MW	Max. Load MW	Load Factor %	Plant Utilization Factor %	Plant Availability Factor %	Plant Capacity Factor %	Gross Heat Rate Btu/kWh			
1	TPS M'garh	1350	1350	1215	85.54	76.99	91.41	90.00	10184	33.51		
2	SPS Faisalabad	132	100	85	81.81	69.54	90.97	64.39	13613	25.07		
3	GTPS Faisalabad	244	190	181	47.37	45.13	91.00	74.18	12223	27.92		
4	NGPS Multan	195	140	40	84.17	24.05	84.17	20.51	14002	24.37		
	GENCO-III	1921	1780	1521	80.76	69.01	90.77	79.18	10895	31.72		



INFORMATION ON PROJECT COST

V #2

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PROJECT COST

(TPS – Muzaffargarh)

Units	PC-1 Cost (Rs. In Million)			Credits (Million in US\$)
	Local	Foreign	Total	
PHASE-I				
210 MW Unit-I				State: 142441
210 MW Unit-II				Commercial: 56.672
210 MW Unit-III	4697.06	3871.00	8568.06	World Bank ESL-II: 2.395
PHASE-II				
210 MW Unit-V				
210 MW Unit-VI	3522.34	2898.66	6421.00	118.575
EXPANSION				
320 MW Unit-IV	2140.00	3720.76	5861.00	124.5465

(SPS – Faisalabad)

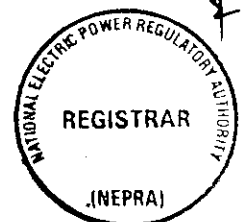
		Rs. Million
F/C	L/C	TOTAL
72.339	162.722	235.061

(GTPS – Faisalabad)

Units	Foreign (million)	Local (million)
Unit No. 1 – 8 1975	DM = 74.000	
Unit No. 9 1994	US\$ = 23.648 BEF = 428.992	Rs. 115.265

(NGPS – Multan)

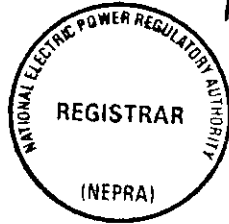
Units	Total Cost (Rs. Million)
Unit No. 1 – 2	118
Unit No. 3 – 4	138



SCHEDULE - II

- The net capacity of the licensee's generation facilities

1/2



INSTALLED CAPACITY (GROSS) & NET CAPACITY

(Northern Power Generation Company Limited)

Power Station	Installed Capacity MW		Derated Capacity (MW)		Net Capacity after *Aux. Consumption (MW)	
Thermal Power Station (TPS) Muzaffargarh	Unit # 1	210	Unit # 1	200	Unit # 1	188
	Unit # 2	210	Unit # 2	200	Unit # 2	188
	Unit # 3	210	Unit # 3	200	Unit # 3	188
	Unit # 4	320	Unit # 4	300	Unit # 4	276
	Unit # 5	200	Unit # 5	200	Unit # 5	182
	Unit # 6	<u>200</u>	Unit # 6	<u>200</u>	Unit # 6	<u>182</u>
		1350		1300		1204
Natural Gas Power Station (NGPS) Multan	Unit # 1	65	Unit # 1	50	Unit # 1	45
	Unit # 3	65	Unit # 3	50	Unit # 3	45
	Unit # 4	<u>65</u>	Unit # 4	<u>50</u>	Unit # 4	<u>45</u>
		195		150		135
Gas Turbine Power Station (GTPS) (Faisalabad)	Unit # 1-7		Unit 1-7		Unit # 1-7	136.67
	(25 x 7)	175	(19 x 7)	133	Unit # 8	18.81
	Unit # 8	25	Unit # 8	19	Unit # 9	<u>35.72</u>
	Unit # 9	<u>44</u>	Unit # 9	<u>38</u>		186.20
		244		190		
Steam Power Station (SPS) Faisalabad	Unit # 1	66	Unit # 1	50	Unit # 1	49.83
	Unit # 2	<u>66</u>	Unit # 2	<u>50</u>	Unit # 2	<u>49.83</u>
		132		100		99.66
TOTAL		1921		1740		1624.86

* **Indicative Figures only:** These figures have been based on historic average auxiliary consumption provided by the licensee. The net capacity available to NGC Licensee for dispatch and other purchasers will be determined through procedures contained in the Grid Code, applicable documents or the bilateral contracts.

