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. NEPRA/R/LAG - 19/7783-84 9.9.2003

General Manager
Chashma Nuclear Power Plant
Pakistan Atomic Energy Commission
Chashma Barrage Colony,
Distt. Mianwali

Subject: **Grant of Generation Licence GL/017/2003**
Licence Application No. LAG - 19
M/s. Chashma Nuclear Power Plant

Please refer to your application No. CNPP-ENGG-1(1)/02, dated 22.10.2002 for a Generation Licence.

2. Enclosed here is Generation Licence No. GL/017/2003 granted by the Authority to M/s. Chashma Nuclear Power Plant. 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.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
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(NEPRA)

9.9.03
(Mahjoob Ahmad Mirza)

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

National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan

GENERATION LICENCE

NO. GL/017/2003

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: -

CHASHMA NUCLEAR POWER PLANT (CHASNUPP)
PAKISTAN ATOMIC ENERGY COMMISSION

Chashma, District Mianwali

an approved Public Sector Project operating under the management and control of Pakistan Atomic Energy Commission (PAEC)

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

Given under my hand this 9th day of September, Two Thousand & Three, and expires on 8th day of September, Two Thousand & Thirty Five.

Registrar

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
REGISTRAR
(NEPRA)

National Electric Power Regulatory Authority
(NEPRA)
Islamabad – Pakistan

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Article 1
Definitions

(1) In this Licence:

a. "Act" means the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (XL of 1997);

b. "Authority" means the National Electric Power Regulatory Authority constituted under section 3 of the Act;

c. "Licensee" means Chashma Nuclear Power Plant (CHASNUPP): and

d. "Rules" means the National Electric Power Regulatory Authority Licensing (Generation) Rules, 2000 as amended from time to time.

(2) 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.

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Article 3
Generation Facilities

(1) 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.

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

Article 4
Term

Pursuant to Rule 5 of the Rules, this Licence is granted for a term of Thirty-two (32) 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

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(b) any contract entered into subsequent to the enactment of the Act between the Licence and another party with the approval of the authority.

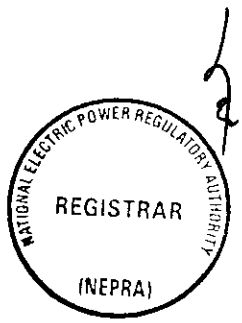
(2) Any variation or modification in the above-mentioned contracts for allowing the parties thereto to participate wholly or partially in the Competitive Trading Arrangement shall be subject to mutual agreement of the parties thereto and such terms and conditions as may be approved by the Authority.

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
Compliance with Nuclear Safety Standards

The Licensee shall comply with all nuclear safety standards and regulations prescribed by relevant competent authorities from time to time.

Article 11
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:

(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.

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(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 11 (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.

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Schedule I

Relevant Information / Supporting Documents

1.	Location	The Chashma Nuclear Power Plant (CHASNUPP) is located about 10 Kms from Chashma Barrage on the left bank of the Indus River in Mianwali district, 32 Kms south of Mianwali city, 280 Kms south-west of Islamabad and 1160 Kms north-east of Karachi. The site is accessible by railroad and tar-macadam roads. (See Annexure-I)
2.	Technology	Nuclear Power Plant (Pressurized Water Reactor) Maximum Gross Capacity = 325 MWe Maximum Net Capacity = 300 MWe Rated Gross Capacity = 310 MWe Rated Net Capacity = 285 MWe
3.	Fuel	Enriched Uranium, imported from China.
4.	Emission Values	Nil
5.	Cooling Water Source	Chashma Jhelum (C.J.) Link Canal at a distance of 300 meters from the Plant.
6.	Interconnection	Chashma Nuclear Power Plant (CHASNUPP) is connected with Daudkhel 220 kV grid by using double circuit. These lines are being used for exporting power to WAPDA but in case of plant shutdown, the power may be taken from this source to run the plant auxiliary systems. It (Daud Khel) is at a distance of 65 Kms from CHASNUPP. Chashma Nuclear Power Plant (CHASNUPP) is also connected with Wan Bhachran 132 kV grid, which is at a distance of 27 Kms from CHASNUPP. In case 220 kV network and the main generator are not available, this source will meet all the auxiliary power requirements for safe shutdown of the plant (See Annexure-II)
7.	Infrastructure	The Chashma Nuclear Power Plant (CHASNUPP) is located at a distance of 10 Kms from Chashma Barrage on the left bank of the Indus River, 32 Kms south of Mianwali city. The plant is connected with Mianwali - Muzafargarh (M-M) road at a distance of 7 Kms east. Railway track (Kundian – Bhakkar) is passing near by the plant and the Plant is connected by a branch track in Alluwali Railway Station. Staff colony is located at a distance of 6 Kms from the plant.
8.	Project cost	Government Funded Project

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9.	Project commencement and completion schedule	Plant construction was started on August 01, 1993 & connection to the National Grid took place on June 13, 2000.
10.	ESSA (Environmental and Social Soundness Assessment)	No Environmental Effect In this regard 'No Objection Certificate' from the Government of Punjab is attached (See Annexure- III).
11.	Safety Plans, Emergency Plans	Title pages of procedures for On-Site Emergency Plan / Off-Site Emergency Plan and approval for Off-Site Emergency Plan are attached (See Annexure-IV).
12.	System Studies	**Load Flow Studies** Detailed load flow studies for Jan. 1999 and Jan. 2000 have been carried out with the assistance of Water and Power Development Authority (WAPDA) to determine the effect of loss of CHASNUPP 300 MW Nuclear unit associated with or without the outage of 220 kV circuits on the transmission system and the outage of maintaining the continuity of power supply to the loads. The primary system power flow characteristics are dominated by available hydroelectric output, which in turn is dependent on the annual water inflows and irrigation demands. High hydroelectric power is only available in the months of June to October. On the average, less than 50% of the maximum hydroelectric energy output is available in the months between January and May. **Results of Load Flow Studies** The results of following twelve (12) important cases (six for the year 1999 and six for the year 2000) are included (See Annexure-V) a. CHASNUPP operating at full power and each of 220 kV circuit delivering half of the transmitted power. i) Study No. 1 for Jan. 2000 ii) Study No. 7 for Jan. 1999. b. Outage of one of CHASNUPP 220 kV circuit and the other 220 kV circuit transmitting the full power. i) Study No. 2 for Jan. 2000 ii) Study No. 8 for Jan. 1999

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c. Loss of CHASNUPP 300 MW unit but both 220 kV circuits remain available.

i) Study No. 3 for Jan. 2000

ii) Study No. 9 for Jan. 1999

d. Loss of CHASNUPP 300 MW unit along with outage of one of the 220 kV circuit.

i) Study No. 4 for Jan. 2000

ii) Study No. 10 for Jan. 1999

e. Loss of CHASNUPP along with the outage of both 220 kV circuits.

i) Study No. 5 for Jan. 2000

ii) Study No. 11 for Jan. 1999

f. CHASNUPP operating at 50%

i) Study No. 6 for Jan. 2000

ii) Study No. 12 for Jan. 1999

All of the above mentioned studies indicate that the load flows and voltages are within the permissible limits and none of the above case imposes any restriction.

Transient Stability Analysis:

The transient stability analysis has been carried out simulating the conditions for Jan. 1999. By that time, CHASNUPP 300 MW will be integrated into the power system and is expected to operate at full power. The month of January has been selected since the reserve capacity of the power system reduces to a minimum value due to significant decrease in the hydro generation capacity. Following five fault conditions were simulated and the angles between different generators are shown in the figures (See Annexure-VI)

i) Three phase fault at Chashma 220 kV bus at T=1 second and CHASNUPP 300 MW unit is tripped when fault is cleared at T=1.1 second (study A).

ii) Three phase fault at Chashma 220 kV bus at T=1 second and Chashma – Daudkhel 220 kV single circuit out when fault cleared at T=1.1 second (Study B).

iii) CHASNUPP 300 MW unit tripped at T=1 second under no fault conditions (study C).

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iv) Three phase fault at Daudkhel 220 kV bus at T=1 second and Daudkhel – Chashma 220 kV single circuit removed when fault cleared at T=1.1 second (Study D)

v) Three phase fault at Daudkhel 220 kV bus at T=1 second and Daudkhel – Peshawar 220 kV single circuit out when fault cleared at T=1.1 second (Study E).

All the cases simulated for transient stability study reveal that the power system will be adequate to maintain continuity of service to the load areas and the off site power to the station auxiliaries at CHASNUPP 300 MW unit.

FREQUENCY STABILITY ANALYSIS

Following five types of frequency stability analysis under different conditions were carried out for Jan. 1999 (See Annexure-VII)

Study No. 1. Three phase fault at Chashma 220 kV bus at T=1 second and CHASNUPP 300 MW unit tripped when fault cleared at T=1.1 second.

Study No. 2 Three phase fault at Chashma 220 kV bus at T=1 second and Chashma – Daudkhel 220 kV single circuit removed when fault cleared at T=1.1 second.

Study No. 3 Unit tripped / outage at no fault conditions.

Study No. 4 Three phase fault at Daudkhel 220 kV bus at T=1 second and Daudkhel – Chashma 220 kV single circuit removed when fault cleared at T=1.1 second.

Study No. 5. Three phase fault at Daudkhel 220 kV bus at T=1 second and Peshawar – Daudkhel 220 kV single circuit removed when fault cleared at T=1.1 second.

All the above-mentioned frequency stability studies are also valid for the year 2000, which indicate that the frequency variations are within the permissible limits.

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<table>
<tr><td>13.</td><td>Plant Characteristics</td><td>

Generation Voltage — 20 kV ± 5%
Frequency — 49.5 Hz ~ 50.5 Hz
Power Factor — 0.85 ~ 0.90
Automatic Generation Control — Base load Plant.

<table>
<tr><td>• Ramping Rate</td><td>Turbine Generator Load range</td><td>Cold Start MWe per min.</td><td>Hot Start MWe per min.</td></tr>
<tr><td></td><td>5% ~ 50%
5% ~ 100%</td><td>0.6 ~ 1
--</td><td>--
1 ~ 3</td></tr>
</table>

Alternative — Step changes in dispatch load of upto 10% are allowable provided the plant load is greater than 15%.
Auxiliary Consumption — 8% of rated power.
Time required to synchronize with grid & load upto 20% of rated power. — 10 min.

</td></tr>
<tr><td>14</td><td>Control, Metering, Instrumentation & Protection</td><td>
Control and Instrumentation Systems are designed to exercise proper control and provide automatic protection against unsafe and improper reactor operations during steady-state and transient power operations. These systems assure that the reactor can be operated to produce power in a manner that assure no undue risk to the health and safety of public. The reactor protection system is provided as defined in IEEE standard 603-1980, "Criteria for Safety Systems for Nuclear Power Generating Stations".
Metering: CHASNUPP metering system consists of following:
a. Metering System for 132 kV line.
Wapda has installed its meters at CHASNUPP and metering is being done according to the readings on monthly basis.
b. Metering System for 220 kV lines.
Main metering system on 220 kV lines has been installed at CHASNUPP for Export / Import purposes. Programming & operation of these meters are awaited from Wapda. Presently the backup meters, installed at Daud Khel Grid are being used for metering purposes.
</td></tr>
</table>

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15	Training & Development	The training program for the key personnel (plant management and supervisory personnel and selected group of technicians) of the oranization was established to provide them with sufficient knowledge and experience to start up, operate, and maintain CHASNUPP in a safe and efficient manner. This training program was developed in consultation with Training Centre of QNPC (Qinshan Nuclear Power Co.), a sub-contractor of CZEC (China Zhongyuan Engineering Corporation), who train manpower for Qinshan Nuclear Power Plant. Appropriate In-Class, On-site and Simulator Training, as recommended in IAEA Safety Guides was provided to the personnel. This training was imparted in two batches. Duration of training was different for different categories of personnel i.e. Licensed Engineers, Maintenance, Technical Engineers and Plant Technical Staff for Maintenance and Operations. These personnel have also received on-site training during installation and commissioning of CHASNUPP. Three months before fuel loading, DNSRP (Directorate of Nuclear Safety & Radiation Protection) conducted the licensing examination of Operation Personnel for the position of Shift Supervisor and Operation Engineers.
16	Feasibility Report	Title pages of Feasibility Report are attached (See Annexure- VIII)
17	Tariff	**See Annexure IX on "Project Cost and Tariff"**
18	Life of Generation Facility	40 Years

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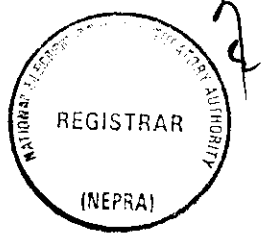
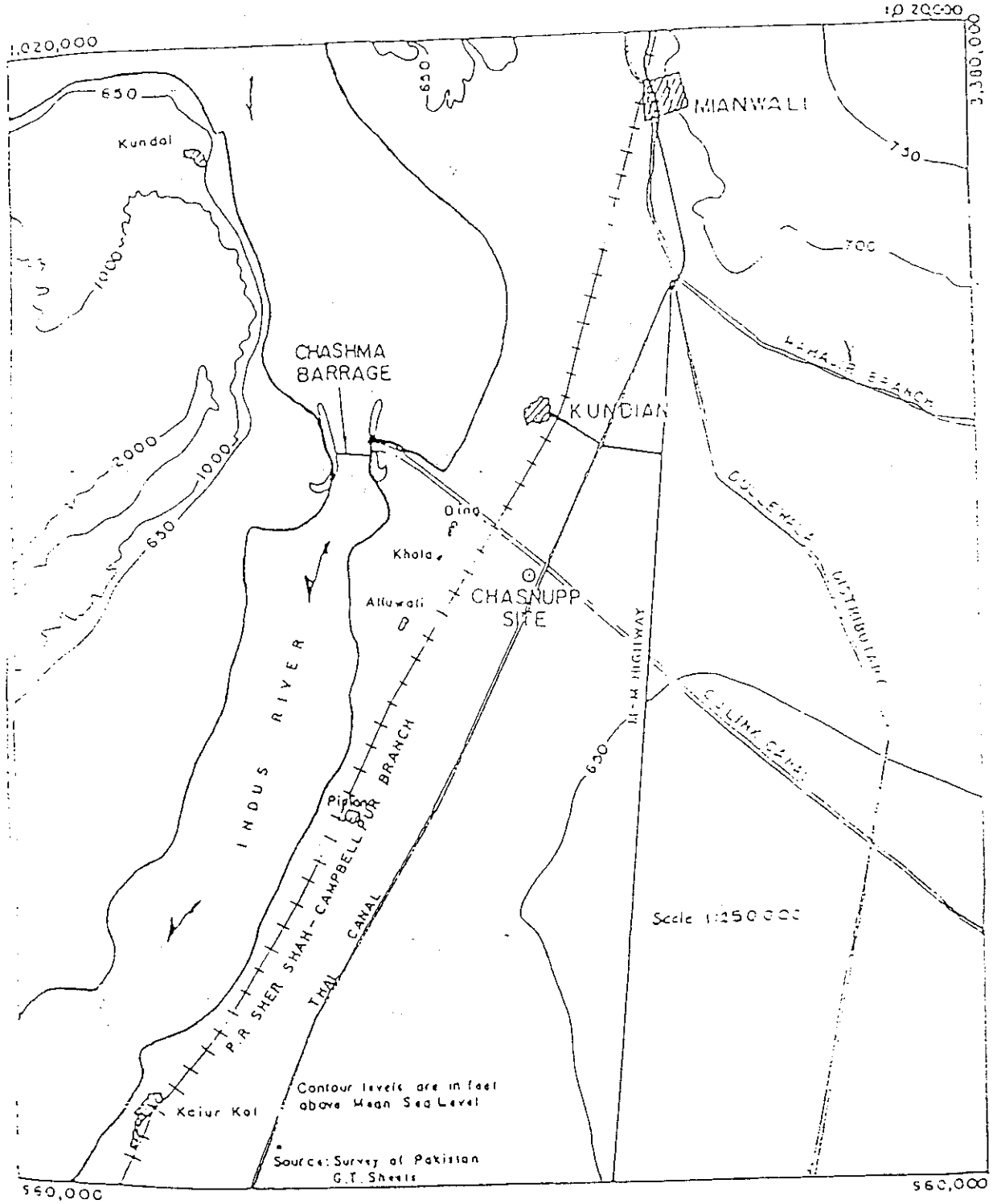
Gross Capacity	325MWe
Net Capacity	300MWe
Thermal Power	998.6MWt
Number of loops	2
Average Coolant Temp.	
at zero load	280°C
at full load	302°C
System working pressure	15.2 MPa
Number of fuel assemblies	121
Fuel (enrichment)	U02 (2.4% - 3%)
Turbine elements	1 HP (double)
	2 LP (double)
Turbine Speed	3000 rpm
Generator Rating	364.7 MVA
Generator Voltage	20 kV





CHASHMA NUCLEAR POWER PLANT UNIT-1
FINAL SAFETY ANALYSIS REPORT

FIGURE
13-3-1
Site Location

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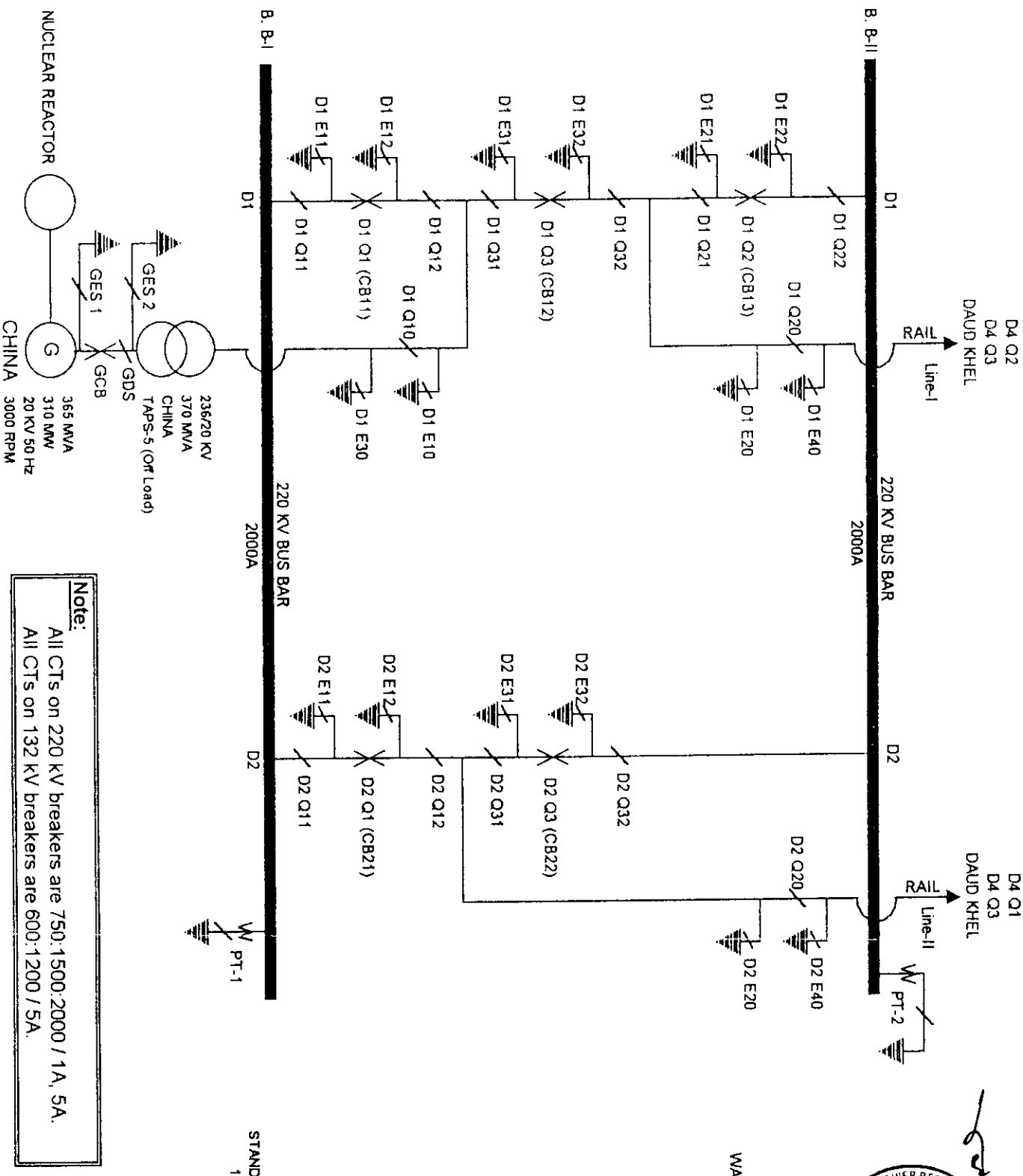

Note:
All CTs on 220 kV breakers are 750:1500:2000 / 1A, 5A.
All CTs on 132 kV breakers are 600:1200 / 5A.

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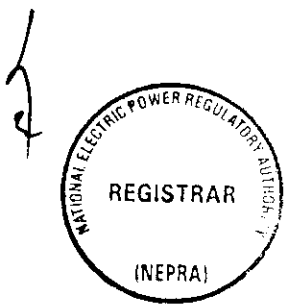
Schedule II

INSTALLED CAPACITY (GROSS) & NET CAPACITY

Maximum Gross Capacity	325MW
Maximum Net Capacity	300MW

Note: **Indicative futures only:** These figures have been estimated 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 bilateral contracts.



DETERMINATION DATED 09, SEPTEMBER 2003

IN THE MATTER OF GRANT OF GENERATION LICENCE

TO

CHASHMA NUCLEAR POWER PLANT ('CHASNUPP')

Pursuant to Section 15 of the Regulation of the Generation, Transmission and Distribution of Electric Power Act (XL of 1997), (hereinafter referred to as the 'Act'), no person shall construct, own or operate a generation facility without a licence granted by the Authority under the Act. Accordingly, Chashma Nuclear Power Plant (hereinafter referred to as 'CHASNUPP') filed an application with the Authority on 22 October 2002 for grant of generation licence.

2. Upon receiving necessary information which had not been provided earlier with the application, the Authority admitted the application on 23 May 2003 for consideration in accordance with the Application and Modification Procedure Regulations, 1999.

3. The notice for admission, which provided the salient features of CHASNUPP, was published in the daily newspapers. Notices were also sent to interested/affected persons according to Regulation 8 of Application and Modification Procedure Regulations 1999. In response to the notice of admission, the Authority received comments from three (3) commentators namely, Pakistan Environmental Protection Agency Islamabad, Member (Power) Water and Power Development Authority and Planning and Development Division (Energy Wing), Islamabad. Consequently, the Authority decided to hold a conference for further consideration of the application. The Authority also circulated a draft generation licence to CHASNUPP and other invitees of the conference. The conference was held in NEPRA head office

Islamabad on 26 June 2003.

4. During the conference, CHASNUPP presented the salient features and background of its power plant and highlighted the importance of nuclear power generation for the country. The participants of the conference expressed their concerns, pertaining mainly, to the reliability, safety and environmental aspects of CHASNUPP's nuclear power plant.

5. As regards the reliability of its power supply to WAPDA, CHASNUPP submitted that after overcoming the initial teething problems its performance record has improved and is now comparable to international utilities. It provided assurance that it would be able to maintain its reliability in the supply of power to the WAPDA system. Statistical information and written comments were provided in support of its claims regarding its performance.

6. The environmental and safety aspects of nuclear power generation are a real concern for all stakeholders and were thoroughly deliberated during the conference. CHASNUPP asserted that it is in compliance with the national and international regulations on environmental protection as prescribed by the concerned authorities. CHASNUPP informed the Authority that it has regularly obtained necessary environmental certification from the relevant authorities. Moreover, it is taking action on the conditions attached to the No Objection Certificate dated 5 October 1998, issued by Environmental Protection Department, Government of Punjab.

7. With respect to the safety of the plant, Pakistan Nuclear Regulatory Authority (hereinafter referred to as 'PNRA') elaborated its regulatory role and highlighted the need of a close monitoring of CHASNUPP according to the

guidelines of International Atomic Energy Agency. CHASNUPP stated that it is following the regulations of PNRA and that there is close liaison between the applicant and the regulator. PNRA however, asserted that its mandate extends only to the monitoring of radiation safety aspects of the plant whereas, other safety considerations are not within the scope of its functions. PNRA also requested that an additional article requiring CHASNUPP to comply with Nuclear Standards prescribed by PNRA should be inserted in the licence. The Authority is of the view that since standards as well as relevant competent authorities may vary from time to time, therefore specifying the same in the Licence may obstruct the future implementation of the Article.

8. According to Section 46(2)(j) of the Act, the Authority may prescribe rules for the safe, reliable and least environmentally harmful supply of electric power. The rules under this Section are however, still to be finalized by the Authority. In view of the stringent regulations of Pakistan Nuclear Regulatory Authority and the requirements of the Environmental Protection Act, the Authority is of the opinion that these agencies provide adequate guidelines for the maintenance of nuclear safety and environmental standards for the time being. The Authority may in due course, prescribe its own standards for compliance, however in view of the nuclear safety and environmental standards prescribed under the PNRA Act and the Environmental Protection Act as well as the expertise available to these agencies for monitoring and implementation of their standards, the immediate prescription of standards by the Authority is not required, at this stage.

9. As regards the reliability of the power provided by the plant, this shall be dealt with in performance standards for generation, which may be prescribed by the Authority. Until such time that the Authority prescribes such performance

standards, the reliability and quality of the supply shall be established in accordance with the Power Purchase Agreement entered into between CHASNUPP and the power purchaser, as approved by the Authority.

WITH THIS the Authority hereby grants the Generation Licence to CHASNUPP.

Fazlullah Qureshi
Member

Mansoor Elahi
Member

Engr. Sardar Muhammad Sharif Khan 'T.St'
Member

Abdul Rahim Khan
Vice Chairman/ Acting Chairman

National Electric Power Regulatory Authority
NEPRA AUTHORITY

DETERMINATION DATED 09, SEPTEMBER 2003

IN THE MATTER OF GRANT OF GENERATION LICENCE

TO

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6. The environmental and safety aspects of nuclear power generation are a real concern for all stakeholders and were thoroughly deliberated during the conference. CHASNUPP asserted that it is in compliance with the national and international regulations on environmental protection as prescribed by the concerned authorities. CHASNUPP informed the Authority that it has regularly obtained necessary environmental certification from the relevant authorities. Moreover, it is taking action on the conditions attached to the No Objection Certificate dated 5 October 1998, issued by Environmental Protection Department, Government of Punjab.

7. With respect to the safety of the plant, Pakistan Nuclear Regulatory Authority (hereinafter referred to as 'PNRA') elaborated its regulatory role and highlighted the need of a close monitoring of CHASNUPP according to the

guidelines of International Atomic Energy Agency. CHASNUPP stated that it is following the regulations of PNRA and that there is close liaison between the applicant and the regulator. PNRA however, asserted that its mandate extends only to the monitoring of radiation safety aspects of the plant whereas, other safety considerations are not within the scope of its functions. PNRA also requested that an additional article requiring CHASNUPP to comply with Nuclear Standards prescribed by PNRA should be inserted in the licence. The Authority is of the view that since standards as well as relevant competent authorities may vary from time to time, therefore specifying the same in the Licence may obstruct the future implementation of the Article.

8. According to Section 46(2)(j) of the Act, the Authority may prescribe rules for the safe, reliable and least environmentally harmful supply of electric power. The rules under this Section are however, still to be finalized by the Authority. In view of the stringent regulations of Pakistan Nuclear Regulatory Authority and the requirements of the Environmental Protection Act, the Authority is of the opinion that these agencies provide adequate guidelines for the maintenance of nuclear safety and environmental standards for the time being. The Authority may in due course, prescribe its own standards for compliance, however in view of the nuclear safety and environmental standards prescribed under the PNRA Act and the Environmental Protection Act as well as the expertise available to these agencies for monitoring and implementation of their standards, the immediate prescription of standards by the Authority is not required, at this stage.

9. As regards the reliability of the power provided by the plant, this shall be dealt with in performance standards for generation, which may be prescribed by the Authority. Until such time that the Authority prescribes such performance

standards, the reliability and quality of the supply shall be established in accordance with the Power Purchase Agreement entered into between CHASNUPP and the power purchaser, as approved by the Authority.

WITH THIS the Authority hereby grants the Generation Licence to CHASNUPP.

Fazlullah Qureshi
Member

Mansoor Elahi
Member

Engr. Sardar Muhammad Sharif Khan 'T.St'
Member

Abdul Rahim Khan
Vice Chairman/ Acting Chairman

National Electric Power Regulatory Authority
NEPRA
AUTHORITY