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TECHNICAL AUDIT REPORT

MUZAFFARGARH 500KV GRID STATION

January 2015

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TECHNICAL AUDIT REPORT

MUZAFFARGARH 500KV GRID STATION

Contract No: AID-EPP-I-00-03-00004
Order No: AID-391-TO-12-00002

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Introduction:

This report covers the technical audit of Muzaffargarh 500kV Grid Station (GS), located near Muzaffargarh thermal power station (TPS), Punjab. This GS was commissioned on 500kV level on March 26, 2000. The power received from the TPS phase 1 and 2 is stepped up to 500kV level at this GS and then injected into 500kV NTDC network and vice versa. The 500kV switchyard is in the NTDC GS while the 220kV switchyard is in TPS phase 2. This GS plays a pivotal role for the dispersal of power from various thermal power stations i.e. Muzaffargarh TPS and IPPs such as AES Lal Pir, AES Pak Gen, PARCO and KAPCO. The GS has 1200MVA transformation capacity connected to the grid.

There are two (02) 600MVA-500/220kV transformer banks that are maintained and owned by NTDC. Three (03) 500kV circuits link this station to others. The GS is connected to Gatti 500kV GS, Multan 500kV GS and Guddu 500kV GS through 500kV transmission circuits. For 500kV switchyard, one and half breaker scheme is used.

EPP audit team comprising technical experts visited this GS from June 16, 2014 to June 27, 2014 to perform technical audit. This report reflects their findings and prioritized fixes.

Findings:

Observations of technical experts are below:

1) Loading condition of transformers is tabulated below:

Transformer No.	Rating			Max. Load Current Recorded (A)	Max. Percentage Loading of transformers (%)
	Voltage Ratio (kV/kV/kV)	Power (MVA)	HV/LV Current (A)		
T-1	500/220/23	600	660/1500	1560	104
T-2	500/220/23	600	660/1500	1430	95.3

Both the transformers are overloaded per NEPRA grid code clause OC 4.9.5 supported by IEC (International Electro-technical Commission) which allows up to 80% loading of transformers. According to IEC Standard 60354, continuous loading of transformer above 80% at ambient temperature equal to or above 40°C, prohibits the transformer's short time overloading beyond its nameplate ratings. Exceeding this limit reduces the expected useful life of transformers in proportion to the amount and duration of overload. Based upon the prevailing loading conditions of these transformers, one (01) 600MVA-500/220kV transformer bank needs to be added.

2) The DGA testing set for testing of oil of transformers at this GS is out of service due to non-calibration of cylinder.

3) The following tests have not been performed as required per SOPs for grid system operation and maintenance:

a. Detailed oil testing and Dissolved Gas Analysis (DGA) test of oil of spare units of transformers and shunt reactors have not been done - In the absence of these tests, the quality of transformer oil and shunt reactors cannot be ascertained in view of the contents of various undesired gases in the oil and other important parameters such as moisture content, flash point, kinematic viscosity, interfacial tension, acidity and tangent delta etc., resulting in breakdown of transformers

b. Leakage current measurement (LCM) test of lightning arresters

c. Capacitance & dissipation factor (C&DF) test of current transformers (CTs), potential transformers (PTs) and capacitor voltage transformers (CVTs)

It is necessary to conduct all tests timely to ensure healthiness of the equipment.

4) Spare parts are not available for eleven (11) 500kV CBs for future overhauling (for details see Annex-B)

5) Sequential event recorders and fault recorders are defective. This data helps engineers to check proper functioning and settings of the protection system and identify components that failed to operate in the event of a fault.

6) The GS is missing around five (05) important relays such as: (For details see Annex-B and D).

a. One (01) Thermal overload protection relay on transformer T-1
b. One (01) Tertiary earth fault relay on T-2
c. Two (02) Distance to fault locators on 500kV Muzaffargarh – Multan and Guddu circuits
d. One (01) DC supply supervision relay

7) The ground clearance of 500kV Muzaffargarh-Gatti circuit in the span of tower number 559/560 is critical due to raised level of bypass road near Shorkot city which may cause a serious hazard. Cracks have developed in the pile foundations of tower No. 484 to 490 in the river bed at Trimu Head. Thermovision survey of all circuits has not been carried out.

8) Preventive and routine maintenance of 220kV switchyard of Muzaffargarh TPS is the responsibility of GENCO-III Muzaffargarh and has been neglected since long. The condition of the equipment is poor due to lack of maintenance. In the past several problems arose in the 220kV switchyard of GENCO-III causing outage of about 1700MW power and the fault was ultimately attended by NTDC personnel.

Recommendations:

Transmission and Grid			
Sr. No.	**Findings**	**Recommendations**	**Remarks**
1	Loading of all 500/220kV transformers is above the prescribed criteria per NEPRA grid code i.e. 80%.	Proper load flow studies need to be conducted and necessary action to be taken to reduce the loading on these transformers	
2	Preventive/ routine maintenance of 220kV switchyard of Muzaffargarh TPS is the responsibility of GENCO-III Muzaffargarh and has been neglected since long. The condition of the equipment is poor due to lack of maintenance.	The matter needs to be discussed and addressed with the relevant GENCO	
3	Detailed oil testing and Dissolved Gas Analysis (DGA) test of oil of spare units of transformers and shunt reactors have not been done	In the absence of these tests, the quality of transformer oil and shunt reactors cannot be ascertained. These tests should be carried out per the SOPs.	
4	C and DF test for CTs and CVTs and LCM for lightening arresters is due.	All tests should be carried out per the SOPs to ensure healthiness of the equipment.	
5	The DGA testing set at this GS is out of service due to non-calibration of cylinder	Efforts should be made for proper calibration of the cylinder in order to make the DGA testing set operative.	
6	Spare parts are not available for eleven (11) 500kV CBs for future overhauling	Spare parts need to be arranged.	

Protection			
Sr. No.	**Findings**	**Recommendations**	**Remarks**
1	Defective sequential event recorders and fault recorders for 500kV system.	It is strongly recommended to make sequential event recorders and fault recorders functional. Such data helps engineers to check proper functioning of protection system and identify the components that fail to operate.	
2	The following relays are not installed: one (01) Thermal overload protection relay on transformer T-1, one (01) Tertiary	Thermal overload and overload (current based) protection has a vital role against sustained overloading. Hence	

	earth fault relay on T-2, two (02) Distance to fault locators on 500kV Muzaffargarh – Multan and Guddu circuits and one (01) DC supply supervision relay	recommended to be installed and configured precisely. All other missing relays need to be installed. (for details see Annex-B and D)	

General			
Sr. No.	**Findings**	**Recommendations**	**Remarks**
1	The ground clearance of 500kV Muzaffargarh-Gatti circuit in the span of tower No. 559/560 is critical. Cracks have developed in the pile foundations of tower Nos. 484 to 490 in the river bed at Trimu Head. Thermovision survey of all circuits is not done.		

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