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TECHNICAL AUDIT REPORT YOUSAFWALA 500KV GRID STATION

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TECHNICAL AUDIT REPORT

YOUSAFWALA

500KV GRID STATION

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Technical Audit of Yousafwala 500kV Grid Station

Introduction:

This report covers the technical audit of Yousafwala 500kV Grid Station (GS), located at Multan road near Sahiwal, Punjab. Originally, it was commissioned at 220kV level on August 20, 1987. Later, it was upgraded to 500kV level on August 07, 2006. It has 1200MVA transformation capacity connected to the grid feeding Sahiwal and its surrounding areas where the load demand is growing rapidly.

There are two (02) 600MVA-500/220kV, four (04) 160MVA-220/132kV transformers, one (01) 26MVA-132/11kV and one (01) 13MVA-132/11kV power transformers at this station that are owned and maintained by NTDC. There are two (02) 500kV, six (06) 220kV and eight (08) 132kV transmission circuits linking this station to others. The GS is connected to Multan 500kV and Sheikhpura Lahore 500kV GSs through 500kV circuits and to Gatti 500kV GS, Sarfaraznagar 220kV GS and Vehari 220kV GS through 220kV circuits. A new Okara 220kV GS is under commissioning and will be linked via both 220kV Yousafwala-Sarfaraznagar circuits. Additionally, new Kassowal 220kV GS is under commissioning and will be linked via both 220kV Yousafwala-Vehari circuits. For 500kV and 220kV switchyard one and a half breaker scheme whereas for 132kV switchyard double bus single breaker scheme is used. Single line diagram is attached (Annex-A).

EPP audit team comprising technical experts visited this GS from January 21, 2014 to February 04, 2014. This report reflects their findings and prioritized fixes.

Findings:

Observations of technical experts are below:

- 1) Overhauling of six (06) 220kV circuit breakers (CBs) and one (01) 132kV CB is pending due to unavailability of spare parts which may affect the healthy and safe operation of the system. (For details see Annex-B)
- 2) Loading condition of transformers is tabulated as under:

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	693/1575	950	60.32
T-2	500/220/23	600	693/1575	950	60.32
T-3	220/132/11	160	420/700	800	114.29
T-4	220/132/11	160	420/700	800	114.29
T-5	220/132/11	160	420/700	650	92.86

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T-6	220/132/11	160	420/700	688	98.29
T-7	132/11.5	13	57/653	656	100.46
T-8	132/11.5	26	113/1305	1120	82.96

From above, it is evident that the 220/132kV 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 a 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. The new Okara 220kV GS and Kassowal 220kV GS under commissioning in the vicinity is expected to share the loading of the 220/132kV transformers at this GS.

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

- a. Leakage current measurement (LCM) test of lightning arresters
- b. 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) The two (02) 500kV and four (04) 220kV isolators provided with remote control operation are inoperative and they are operated manually in the switchyard. This result in unwanted delays of operation of the equipment

5) Tele-protection, direct transfer trip (DTT) and tie line protection (a feature available in distance protection relay) is out of circuit on all 220kV circuits. On 220kV circuits, six (06) synchro-check relays are not installed. (For details see Annex-B and D)

6) Six (06) Distance Protection Relays on 132kV circuits are old electromechanical type and erratic in operation causing indiscriminate tripping at times.

7) The following relays are not installed/inactive/defective on 220/132kV and 132/11kV transformers:

- a. Three (03) thermal overload protection relays are not installed
- b. Three (03) overload (current-based) protection relays are not installed
- c. Three (03) over-excitation relays are old and unselective
- d. Two (02) main differential protection relays are malfunctioning
- e. Four (04) AVR relays not installed
- f. Two (02) remote oil temperature indicators and one winding temperature indicator are not installed

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Overall, seven (07) relays have been blocked, four (04) relays are defective and fifty five (55) relays are not installed at this GS. (For details see Annex-B)

- 8) HV connection, LV connection and rough balance differential relays are not installed on three (03) 220/132kV transformers to sectionalize the differential zones. Also, cross trip scheme is not installed on all 220/132kV transformers.
- 9) Auto-reclosers on all 220kV and 132kV transmission lines are blocked. Auto-reclosers can significantly reduce the outage time, reduce transmission line damage and thus provide higher service continuity.
- 10) Spare parts are not available for eight (08) 500kV CBs, eighteen (18) 220kV CBs and two (02) 132kV CBs for overhauling in near future. (For details see Annex-B).

Recommendations:

Transmission and Grid			
Sr. No.	Finding	Recommendations	Remarks
1	Overhauling of seven (07) CBs is pending due to unavailability of spare parts.	Spare parts for six (06) CBs of 220kV and one (01) CB of 132kV should be arranged for internal inspection/major maintenance.	NTDC have trained staff and workshop facilities for overhauling and repair of CBs
2	Overloading of 220/132kV transformers.	Proper load flow studies need to be conducted keeping in view the energization of Okara 220kV GS and Kassowal 220kV GS in near future in order to reduce loading on the 220/132kV transformers	
3	Leakage current measurement (LCM) test of lightning arresters, SF6 purity and moisture content test for circuit breakers and capacitance and dissipation factor (C&DF) test of CTs, PTs and capacitor voltage transformers (CVTs) is not done	These tests need to be done to ascertain and ensure healthiness of the equipment.	

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4	Spare parts are not available for eight (08) 500kV CBs, eighteen (18) 220kV CBs and two (02) 132kV CBs for overhauling in near future	Spare parts to be arranged for major maintenance.	
5	The two (02) 500kV and four (04) 220kV isolators provided with remote control operation are inoperative and they are operated manually in the switchyard	The defective motor drive of isolators should be fixed.	

Protection			
Sr. No.	Finding	Recommendations	Remarks
1	Teleprotection (carrier aided) tripping facility is missing on almost all 220kV lines. Inoperative direct transfer trip (DTT) system. On 220kV circuits, five (05) synchro-check relays are not installed	“System Protection and Telecommunication departments of NTDC” should look into it and make concerted efforts to enable “Carrier aided facility” at either ends of the transmission lines in order to clear faults rapidly. The synchro check relays need to be installed	
2	Absence of three (03) thermal overload protection relays on 220/132kV transformers. There are three (03) defective remote temperature indicators on transformers	Thermal overload protection has a vital role against sustained overloading. Hence recommended to be installed and configured precisely. Furthermore, it is recommended to replace all defective remote indicators or calibrate them for proper monitoring of transformer temperatures	
3	Tie protection is not active on all 220kV circuits	It is strongly recommended to make it active	
4	Six (06) distance protection relays on 132kV circuits are old electromechanical type and erratic in operation	Recommended to be replaced or repaired for proper protection.	
5	Absence of HV connection, LV connection and rough balance differential relays on three (03) 220/132kV transformers.	Needs to be installed to sectionalize the differential zones.	

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6	Seven (07) relays have been blocked, four (04) relays are defective and fifty five (55) relays are not installed.	Replacement of faulty, blocked and missing relays.	
7	Auto reclosing is inactive for all 132kV circuits.	"System Protection" and "System Operations" departments have to review the matter and take appropriate action for restoration of autoreclosers. This can significantly reduce the outage time, reduction in transmission line damage and thus provide higher service continuity	

General			
Sr. No.	Finding	Recommendations	Remarks
1	Thermovision survey of GS is not done	Thermovision survey needs to be carried out to avoid any major breakdowns	

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