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TECHNICAL AUDIT REPORT HALA ROAD 220KV GRID STATION

January 2015

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TECHNICAL AUDIT REPORT

HALA ROAD 220KV GRID STATION

Contract No: AID-EPP-I-00-03-00004

Order No: AID-391-TO-12-00002

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Technical Audit of Hala Road 220kV Grid Station

Introduction:

This report covers the technical audit of Hala Road 220kV Grid Station (GS) located on Hala road about 07km to the north of Hyderabad, Sindh. This GS was commissioned on June 02, 1990. It has a total of 480MVA transformation capacity and feeds a major portion of Hyderabad and its surrounding areas.

There are three (03) 160MVA-220/132kV autotransformers, two (02) 20/26MVA-132/11kV and one (01) 40MVA-132/66kV power transformers installed at this GS that are owned and maintained by NTDC. Two (02) 220kV and eight (08) 132kV circuits link this station to others. The GS is fed radially from Jamshoro 500kV GS through 220kV double circuit transmission line. For 220kV switchyard and 132kV switchyard double bus single breaker scheme is used. Single line diagram is attached (Annex-A).

EPP audit team comprising transmission and protection experts visited this GS from September 22, 2014 to October 3, 2014. This report reflects their findings and prioritized fixes.

Findings:

Observations of technical experts are given below:

1. The loading condition of transformers is tabulated below:

Transformer No.	Rating			Max. Load Current Recorded (A)	Max. Percentage Loading of transformer (%)
	Voltage Ratio (kV/ kV/ kV)	Power (MVA)	HV/LV Current (A)		
T-1	220/132/11	160	420/700	685	97.85
T-2	220/132/11	160	420/700	630	90.0
T-3	220/132/11	160	420/700	690	98.5
T-4	132/11.5	26	113/1305	1176	90.11
T-5	132/11.5	26	113/1305	1284	98.39
T-6	132/66	40	178.5/ 356.7	110	30.83

From above, it is evident that all 220/132kV and 132/11kV transformers are loaded above the prescribed limits 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 loading beyond its nameplate ratings. Exceeding this limit reduces the expected useful life of transformers in proportion to the amount and duration of overload.

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2. Loading condition of both 220kV circuits is such that outage of any one circuit affects the other, in case the bus bars are coupled. As both the 220kV circuits are fed from a single source, possibility of collapse of the system is higher. The loading of 220kV Jamshoro-Hala road circuits is above the prescribed limits per NEPRA grid code i.e. 80%.
3. Transformer T-4 is running at a fixed tap position (tap # 12) due to damaged selector switch. Tap changer's operations are required for regulation of the output voltage to desired levels. Also, tap changer for transformer T-5 and T-6 is operated locally in the switchyard.
4. Both 220kV and 132kV bus couplers are out of circuit. The 220kV bus coupler is not yet commissioned whereas 132kV bus coupler is inoperative due to fault in the mechanism of circuit breaker.
5. Major maintenance of three (03) 220kV and nine (09) 132kV circuit breakers is pending due to unavailability of spare parts. Also, major maintenance of two (02) 220kV and five (05) 132kV circuit breakers will be due in near future. Moreover, one (01) 66kV breaker is operated locally in the switchyard. (For details see Annex-B)
6. Two (02) 132kV circuits Hala Road - Tando Jam and Hala Road - Hala (Old) are overloaded.
7. Eleven (11) 220kV and thirty (30) 132kV isolators are operated manually in the switchyard. Also, some of the 132kV isolators have improper alignment.
8. Interlocking system of 132kV switchyard is not functional, which is a serious threat to the system.
9. Seventeen (17) cells of station battery bank-1 (220VDC) are damaged. Also for 110V system, only one set of station battery is available.
10. The following tests are not being performed as required per SOPs for grid system operation and maintenance:
 - a. Purity and moisture content test of SF6 for circuit breakers
 - b. Dissolved gas analysis test of oil for transformers
 - c. Detailed oil testing of transformers
 - d. Leakage current measurement (LCM) test of lightning arresters
 - e. 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.

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11. Both the capacitor banks installed on power transformers T-4 and T-5 are out of circuit due to damaged links.
12. During earthing mesh test, the mesh was found broken at twenty nine (29) points. Twenty one (21) points have been attended. Work for rectification of the remaining ones is in progress.
13. On 220kV Hala Road - Jamshoro circuits, several discrepancies exist i.e. missing of sky wire at certain locations, mechanical failure of disc insulators, deteriorated conductor, excessive number of joints, absence of a number of dampers and clearance problems due to construction of new housing schemes.
14. Tele-protection is out of circuit on both 220kV circuits. Also, direct transfer trip (DTT) facility is not available in 220kV system.
15. The following relays are either not installed or defective on 220kV and 132kV circuits:
 - a. Two (02) Distance to fault locators are defective and two (02) are not installed on 220kV circuits.
 - b. Two (02) tie line protection relays are not installed on 220kV circuits.
 - c. Two (02) alarm supply supervision are not installed on 220kV circuits.
 - d. Two (02) closing supply supervision are not installed on 220kV circuits.
 - e. Sixteen (16) trip circuit supervision relays on 220kV and fourteen (14) on 132kV breakers are not installed.
 - f. Six (06) backup earth fault protection relays are not installed on 132kV circuits.
16. HV connection and LV connection differential relays are not installed on transformer T-1 and T-2 to sectionalize the differential zones. Also, rough balance differential relay is missing on transformer T-2. Moreover, cross trip scheme is not installed on all 220/132kV transformers. (For details see Annex-B)
17. The following relays and equipment are not installed or defective on transformers:
 - a. One (01) over excitation relay
 - b. Six (06) thermal overload protection relays
 - c. One (01) oil temperature protection (Electronic)
 - d. Five (05) overload (current based) protection
 - e. Two (02) alarm supply supervision relays
 - f. Two (02) closing supply supervision relays
 - g. Six (06) trip circuit supervision relays on 220kV and five (05) on 132kV breakers are not installed.
 - h. Four (04) remote winding temperature indicators
 - i. Four (04) remote oil temperature indicators

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18. The 220kV breaker failure scheme and differential protection for 220kV bus bar-1 & 2 are not in circuit. For 220kV breaker failure scheme, bus coupler has not been included in breaker failure scheme, without that breaker failure scheme is incomplete. Whereas differential protection scheme for 220kV bus bar-1 and 2 is not implemented.
19. Auto-reclosers are blocked on all 132kV transmission lines.
20. Sequential event recorders, fault recorders and power recorders are out of circuit due to missing modules and lack of maintenance. Voltage recorders are not installed. This data helps engineers to check proper functioning of the protection system and identify components that failed to operate as required per scheme.
21. For SCADA system, thirty percent (30%) control signals, status indications, protection alarms and measurements are not going to NPCC.
22. For 66kV system, no auxiliary control panel is available for 132/66kV transformer and no protection panel is available for 66kV line.
23. List of missing relays and other defective equipment is attached. (Annex-D)

Recommendations:

Transmission and Grid			
Sr. No.	Findings	Recommendations	Remarks
1	Insufficient existing 220kV feeding source.	One additional 220kV feeding source needs to be linked to the GS as the existing 220kV feeding links are insufficient in case of any fault.	
2	The loading of 220kV Jamshoro-Hala circuits and two (02) 132 kV circuits is above the prescribed limits per NEPRA grid code i.e. 80%.	For the 132kV circuits NTDC needs to take up the matter with HESCO. Addition of a second source will help share load of the 220kV Jamshoro circuits.	
3	Loading of 220/132kV and 132/11kV transformers is above the prescribed limits per NEPRA grid code i.e. 80%.	At least one 220/132kV and one 132/11kV transformer needs to be augmented.	
4	Inoperative 220kV and 132kV bus couplers.	The 220kV bus coupler needs to be commissioned and the 132kV bus coupler's breaker should be put back into service.	
5	Inoperative interlocking system of 132kV switchyard.	Should be made operative for system stability.	

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6	Inoperative 220V station battery (set-1) and requirement of one more station battery bank for 110V system.	For 220V, a new battery bank needs to be arranged. Also for 110V system, one more bank along with charger needs to be provided.	
7	Delay in overhauling of three (03) 220kV and nine (09) 132kV circuit breakers.	Three (03) 220kV and nine (09) 132kV circuit breakers need spare parts for major maintenance.	NTDC have trained staff and workshop facilities for overhauling and repair of C.Bs.
8	Inoperative capacitor banks installed on transformers T-4 and T-5	Needs to be made operative.	
9	Broken earthing mesh at some points.	Work on rectification of the broken points needs to be expedited.	
10	Local operation of tap changer for transformers T-5 and T-6. Moreover, damaged selector switch of transformer T-4.	Remote operation needs to be made functional. Also, damaged selector switch need to be replaced.	
11	Purity and moisture content test of SF6 for circuit breakers, dissolved gas analysis and detailed oil testing of transformers, leakage current measurement (LCM) test of lightning arresters, C&DF test of CTs, PTs and CVTs are not being done.	All these tests should be carried out to ensure healthiness of the equipment.	
12	Manual operation of forty one (41) isolators in the switchyard.	Eleven (11) 220kV and thirty (30) 132kV isolators are operated manually. The remote operation system to be made functional. Also, improper alignment of some 132kV isolators needs to be set right.	

Protection			
Sr. No.	Findings	Recommendations	Remarks
1	In-operative tele-protection on both 220kV circuits and direct transfer trip (DTT) of 220kV system.	“System Protection and telecommunication departments of NTDC” should look into it and make concerted efforts to enable “Carrier aided facility” at	

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		either ends of the transmission lines in order to clear faults rapidly.	
2	Sequential event recorders, fault recorders and power recorders for 220kV system are out of circuit due to missing modules.	It is strongly recommended to make sequential event recorders, fault recorders and power recorders functional. Such data helps engineers to check proper functioning of protection system and identify the components which failed to operate as expected.	
3	Absence of voltage recorders for 220kV system	Need to be installed for proper monitoring of the system.	
4	Tie line protection is not installed on 220kV circuits.	It is strongly recommended to make it active.	
5	The 220kV breaker failure scheme and differential protection scheme for 220kV bus bar-1 & 2 are out of circuit	Both of the schemes need to be implemented as early as possible so to secure the system.	
6	Absence of thermal overload protection relays on all transformers and over load (current based) protection relays on T-2 and both 132/11kV transformers.	Thermal overload and overload (current based) protection has a vital role against sustained overloading. Hence recommended to be installed and configured precisely.	
7	Absence of HV connection, LV connection differential relays on T-1 and T-2 and missing rough balance differential relay on T-2 transformer.	Needs to be installed to sectionalize the differential zones.	
8	Absence of cross trip scheme on all 220/132kV transformers.	Recommended to be installed for protecting the system from total collapse due to overload.	
9	Absence of auxiliary control panel and protection panel for 132/66kV transformer and 66kV line respectively.	Both auxiliary control panel and protection panel for 66kV system needs to be provided.	
10	Replacement of faulty, blocked and missing relays.	Needs replacement with latest version.	
11	Blocked auto-reclosers on all 132kV transmission lines.	This can significantly reduce the outage time, reduction in transmission line damage and thus provide higher service continuity.	

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General			
Sr. No.	Findings	Recommendations	Remarks
1	Discrepancies on 220kV Hala Road – Jamshoro transmission circuits.	Being the only feeding source for this grid station, all the problems need to be resolved at the earliest possible.	
2	Inoperative SCADA system.	Almost thirty percent (30%) work is pending which needs to be completed and final testing and commissioning needs to be done.	

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