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TECHNICAL AUDIT REPORT

NKI 500KV GRID STATION

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NKI 500KV GRID STATION

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Introduction:

This report covers the technical audit of NKI 500kV Grid Station (GS) located on Karachi Northern bypass about 30km from Karachi city, Sindh. This GS was commissioned on May 5, 2006. It has a total of 1200MVA transformation capacity. It is a main source for feeding 220kV system of K-Electric.

There are two (02) 600MVA-500/220kV autotransformers installed at this GS that are owned and maintained by NTDC. Two (02) 500kV and two (02) 220kV transmission circuits link this station to others. The GS is linked to Hub thermal power station and Jamshoro 500kV GS through 500kV transmission circuits whereas KDA 220kV GS and Baldia 220kV GS of K-Electric are fed from this station through 220kV circuits. This GS is an interconnection station between NTDC and K-Electric and plays a pivotal role in dispersal of power generated at Hub thermal power station. Mesh scheme is being used for 500kV and 220kV GIS switchyards. Single line diagram is attached (Annex-A).

EPP audit team comprising transmission and protection experts visited this GS from November 11, 2014 to November 20, 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 Recorded (Amp)	Max. Load Recorded (Percentage)
	Voltage Ratio (kV/kV/kV)	Power (MVA)	HV/LV Current (A)		
T-1	500/220/23	600	660/1500	975	65%
T-2	500/220/23	600	660/1500	975	65%

2. The following tests have not been performed as required per SOPs for grid system operation and maintenance:
    a. Contact resistance test and opening/closing timing test for circuit breakers (CBs).
    b. Dissolved gas analysis and detailed analysis of oil tests for transformers.
    c. Capacitance & dissipation factor (C&DF) test for transformers, 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.

3. The towers and hardware of first ten towers of 500kV NKI-Hub circuit have rusted due to severe humid environment along the seashore. Shield wire from locations 1 to 35 is also

damaged. Moreover, thermos-vision survey of the entire transmission line has not been carried out.

4. At certain locations of 500kV NKI-Jamshoro transmission line, spacers are damaged affecting the conductor. At some locations, sky wire is also damaged.

5. For secured metering system (SMS) PTs have been installed but CTs are yet to be installed. The work is delayed due to unavailability of hardware.

6. One fault recorder for 500kV and one for 220kV are not functional due to hardware problem. Voltage and power recorders are defective since commissioning. This data helps engineers to check proper functioning of the protection system and identify components that failed to operate.

7. Distributed control system is not in working condition being old version and license expiry.

8. Following missing relays need to be arranged and installed on the concerned DC Auxiliary Control panels:

    a. Two (02) 220 VDC Under Voltage relays
    b. Two (02) 220 VDC Earth Leakage relays
    c. One (01) 48 VDC Under Voltage relay
    d. One (01) 48 VDC Earth leakage relay

Recommendations:

Transmission and Grid			
Sr. No	**Findings**	**Recommendations**	**Remarks**
1	Dissolved gas analysis and detailed analysis of oil tests for transformers are pending.	These tests need to be done on priority basis to ascertain and ensure healthiness of the transformer oil.	
2	SF6 purity and moisture content test for CBs 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 on priority basis to ascertain and ensure healthiness of the equipment. Maintenance personnel are required to be trained in maintenance activities of GIS.	
3	For SMS CTs are not yet installed.	The matter regarding procurement of hardware to be expedited.	

4	Distributed control system is not in working condition.	The software license expiry issue is recommended to be solved by NTDC with the help of Siemens Contractor and both the systems need to be made in working condition.	

Protection			
Sr. No	**Findings**	**Recommendations**	**Remarks**
1	Voltage and power recorders, one fault recorder for 500kV and one for 220kV are not functional.	The spare fault recorders, already available, are recommended to be wired and programmed in place of faulty fault recorders. Faulty fault recorders need to be got repaired from SIEMENS or be replaced. Power and Voltage recorders are recommended to replace.	
2	Six (06) relays are missing in DC auxiliary control panels.	Need to be installed.	

General			
Sr. No	**Findings**	**Recommendations**	**Remarks**
1	Towers and hardware of first ten locations of 500kV NKI-Hub circuit have rusted; shield wire is also injured at few locations. Moreover, Thermovision survey of all transmission lines has not been carried out.	Proper action is required to avoid collapse of the towers. Also, Thermovision survey of the entire line is essential to be done regularly.	
2	Spacer dampers at certain locations of 500kV NKI-Jamshoro are damaged causing damage to conductor. Sky wire is also damaged at few locations.	Proper remedial measures and repair or replacement of sky wire are required.	

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