

REPORT OF THE GROUP

ON

**FREQUENT TRIPPING OF PANIPAT, MAU
AND MURADNAGAR S/STNS IN
NORTHERN REGION**

**NORTHERN REGIONAL POWER COMMITTEE
New Delhi
FEB 2010**

Index

Chapter	Description	Page No.
1	Introduction	3
2	Visit of 400 kV sub station at Panipat	3-6
3	Supply to Railways from Panipat station	6-7
4	Visit of 400KV substation at Muradnagar	7-9
5	Visit of 400 kV Mau Sub station	9-11
6	Recommendations	11-13
	Acknowledgement	14

Report of the Group on Frequent Tripping of Panipat, Muradnagar and Mau Sub-station in NR

1.0 INTRODUCTION

- 1.1 Northern grid experienced two partial grid disturbances on the 2nd January 2010. One at 0301 hrs due to fog related depletion of network and other at 2154 hrs due to problem in tripping of lines due to fault in Delhi system. This incidents severely affected power supply and railway supply in the North West part of the Northern grid CEA has constituted a committee to enquire into these incidents.
- 1.2 Mean while Joint Secretary (Trans.), MoP, held a meeting on 18th January, 2010 regarding breakdown of power supply to railways and to find the remedial measure to mitigate the breakdown of power supply to railway during Grid Disturbances. During this meeting one of the issue flagged was frequent tripping of 400 kV Sub-stations at Panipat (BBMB), Muradnagar (UPPTCL) and Mau (UPPTCL) affecting the grid security. It was decided that Member Secretary, NRPC may constitute a group who should visit these sub-stations, analyses the possible causes and suggest the remedial measures to avoid frequent tripping at these s/stns in future.
- 1.3 NRPC vide their order No. NRPC/SE(O)/Railway_Supply dated Date: 19-01-2010 constituted a group to visit these three sub-stations, analyze the possible causes and suggest the remedial measures to avoid recurrence of such disturbances in future.

The Members of the group constituted are given as under:

- 1 Sh. V. P. Trivedi, Chief Engineer, Power System, UPPTCL
- 2 Sh. K. B. Sharma, Chief Engineer, (SO), BBMB, Chandigarh
- 3 Sh. R. K. Garg, Chief Engineer (TS), HVPNL, Panchkula
- 4 Sh. Ajay Talegaonkar, Director, GM Division, CEA
- 5 Sh. Bhaskar Sharma, General Manager, POWERGRID NR-I, New Delhi
- 6 Sh. D.K. Jain, DGM, NRLDC, New Delhi
- 7 A representative of Railways
- 8 SE (O), NRPC, Convener

- 1.4 The group visited Muradnagar, Panipat and Mau sub stations on 27th Jan 2010, 28th Jan 2010 and on 1st Feb 2010 respectively. The observation / finding of the group on these substations are given in the following paras.

2.0 Visit of 400 k V PANIPAT SUB STATION

- 2.1. Panipat substation of BBMB is very important substation of the Northern Grid as it connects BBMB system to Delhi ring system. It serves as link between central part of NR grid and Haryana & Punjab systems, which then connects J&K, HP system. The sub-station has two Inter Connecting Transformer (ICT) banks (each of 450 MVA) of 400/220 kV, two transformers (each of 100 MVA) of 220 / 132 kV and one transformer (60 MVA) of 220/ 33 kV. It has breaker and a half bus bar scheme. The 400 kV system is connected to Dadri by D/C line and to Dehar by S/C line. The

- 220 kV side is connected to Panipat TPS by two D/C lines. Additionally, there are 7 circuits of 220 kV emanating from this sub-station besides 6 circuits of 132 kV and 6 circuits of 33 kV.
- 2.2. Many tripping were reported in the foggy season during the winter of 2008-09 as well as current winter season. During current winter season, tripping have been reported on 31st December 2009 and 2nd, 6th, 7th, 8th, 9th, 17th, 18th and 22nd January 2010.
 - 2.3. The reason for these tripping appears to be prevalence of fog coupled with high level of pollution. There are various contributing factors, which lead to deposition of pollutants on the sub-station insulators. Firstly, Panipat substation is located on NH-1 with heavy vehicular traffic. Secondly, there are many industries in the vicinity of this substation, closest being National Fertilizers Limited (NPL) having a coal based captive power plant, which is at a radial distance of about 1 km. from this sub-station. Other nearby industries include Panipat Thermal Power Station of Haryana Power Generation Corporation Ltd and many small scale weaving and dying units. From the NH-1 itself, the Group members observed visible smoke coming out of chimneys of the captive power plant of NFL. The Group recommends that BBMB may take up the matter with NFL and Haryana Pollution Control Board so that emissions of particulate matter from NFL captive power plant can be brought within permissible limits.
 - 2.4. The Group noted that on two occasions, first at 1.29 Hrs of 17.01.2010 and second at 02.25 Hrs on 22.01.2010 entire 400 kV system of Panipat sub-station became dead. It was found that on both the occasions, the trippings were started due to tracking on isolator poles, which normally should have lead to de- energization of bus bar –II and shifting of all 400 kV circuits to bus bar –I. The substation authorities explained that the problem has been identified and necessary action to rectify the same has already been taken. It was explained that isolator's auxiliary contacts were wired in series with trip relay coils, which was actually not required for breaker and a half scheme. BBMB intimated that the same was done as per English electric drawings. These auxiliary contacts have now been bypassed and such incident is not expected to recur.
 - 2.5. One important difference has been observed in the tripping that took place last winter season vis-à-vis those during this winter season. That while in last season, transmission lines emanating from this substation were getting tripped under foggy conditions, but during this winter season substantial number of tripping have taken place inside the substation itself. This can perhaps be attributed to the fact that the porcelain insulators on the lines in the area around Panipat and 220/132 kV switch yard have been replaced by polymer/ antifog insulators but the insulators in the substation equipment, including support for circuit breakers, CT, isolators etc are of conventional types .
 - 2.6. During interaction with the Group members, substation authorities expressed apprehension that in some of the flashover incidents, there appears to be direct arcing through the air between the metallic parts. This apprehension was based on the premise that in some such flashover incidents, metallic parts which are not even in shortest aerial path have been damaged. Some pictures of such damaged equipment are shown below:



- 2.7. The Group is of the opinion that such direct flashover through the air without tracking through insulator may not have happened. However, when flashover takes place through the insulator, the air in the vicinity gets ionized and thereafter arcing through the air may follow. Therefore, Group members are of the opinion that primary cause of flashover through the air is tracking through the insulators. The Group recommends that wherever flashover through the air has been observed, the insulators should be replaced because they would have developed inherent weakness due to flashover. In order to avoid insulator flashover at the substation, the group opines that whenever new insulators are procured for replacing existing insulators, the specifications in respect of creepage distance should be enhanced to 35 mm / kV as against existing norm of 25 mm/kV. The Group also recommends that Basic Insulation Level for new equipment may also be increased.
- 2.8. BBMB has replaced all Air Blast Circuit Breakers (ABCB) with SF-6 circuit breakers except five circuit breakers at 220 kV level. It was further informed that SF-6 circuit breakers for replacing the remaining ABCB have already arrived at the substation and the replacement shall take place in due course subject to shut down being allowed by NRLDC.
- 2.9. The Group noted that voltage at 400 kV Panipat bus was on higher side and this could have contributed towards flashovers reported at the substation. The Group feels that one possible reason for over voltage at Panipat bus is that 400 kV Dehar- Panipat and Dehar – Bhiwani lines are of relatively longer length and are often lightly loaded. The Group recommends that possibility of looping in and looping out of these lines at some intermediate locations may be explored to address the problem of high voltage being experienced at 400 kV Panipat bus during winter seasons.
- 2.10. On physical inspection, the Group noted that the pollutants on the insulators were not sticky in nature, so it should be possible to clean them with high pressure jet. The Group recommends that the substation should switch over to hot line cleaning using high pressure jet on priority basis. The DM water required for hot line cleaning can be obtained from Panipat TPS which is not very far away. The Group also recommends that the substation should experiment with Silicon grease on insulators in one of the bay equipment. The Silicon grease could be applied in equipment of selected bay before the onset of next winter preferably in October, 2010. The substation authorities can then review performance based on number of tripping at the end of the winter and accordingly decide future course of action.

- 2.11. It was also noted that while protection for lines emanating from the substation has been converted from analogue relays to numerical relays, the same has not been done in so far as bus bar is concerned. Numerical relays brings in the advantage that they have disturbance recording facility in each bay unit as well as central unit. The 220 kV system at Panipat substation is more than 20 years old and some new bays have also been added since then. Further, the Group observed that un-intended tripping have taken place on 220 kV side. The Group, therefore, recommends that the whole system of bus bar differential protection of 220 kV system should be replaced with numerical relay. This will enhance reliability of protection scheme. It will also help in identifying location of fault more accurately because it will have facility to measure current in each bay independently. Further, analogue protection for 400 kV system bus bar may also be replaced by numerical relay based protection. The numerical relays will also facilitate disturbance recording, which is a mandatory requirement under section 9 of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007.
- 2.12. The Group was appraised by the sub-station authorities that they have analysed the problem in the existing analogue relays of 220 kV bus bar protection and have come to conclusion that sensitivity of the existing relays can be increased by including stabilizing resistance so as to change impedance from 400 Ω to 1000 Ω . The Group recommends that this should be done immediately so that existing analogue relays perform reliably till these relays are replaced by numerical relays as mentioned earlier.
- 2.13. The Group also noted that on 17-1-2010 when 400 kV system was dead, the 220 kV system was live and yet the in coming lines from Panipat TPS tripped. It was reported by substation authorities that this unintended tripping was due to malfunction of distance protection on zone 3 at Panipat TPS end. It was further reported that the problem has been rectified and such incidents will not recur in future.
- 2.14. The Group noted with satisfaction that the substation authorities have prepared Annual Maintenance Plans for each equipment. It was further reported that Tan-Delta Tests are carried out on equipment once in two years and on yearly basis for equipment with vintage of 25 years or more. Almost entire sanctioned man power was in place and no constraint is reported to be experienced on this account. The PLCC system is reported to be working at the desired level.
- 2.15. The Group observed that at some places, the wiring used for protection and instrumentation needs replacement. This task should be taken up by the Station authorities on priority basis.
- 2.16. The Group observed that the inbuilt event logger in the SCADA system is not accessible to substation engineers. This feature should be enabled immediately so that substation engineers can view events taking place in the substation, can do internal analysis and take remedial measures, if required.

3.0 Supply to Railways from Panipat station.

- 3.1 The Railways traction supply on Delhi-Ambala and Ambala-Amritsar routes was affected on account of the disturbance for a short duration.
- 3.2 The supply to railways was also affected to Delhi-Howrah section from Dadri (Dankaur) feeding point despite the Dadri (Gas) station being live,

- due to tripping of Railways` own 220 kV inter-connector between Dadri (Gas) and Dadri (Dankaur) Railway Traction Sub-station. The supply to this section was extended from 220 kV Auraiya section by the Railways itself.
- 3.3 Delhi-Ambala route is fed through Diwana railway grid-station over a stretch of 200 km. Diwana grid station of railways is connected to Panipat Thermal Power Station (PTPS) and alternative to Safedon. Railway representative showed concern over failure of railway traction supply from HVPNL and Panipat Thermal Power Station (PTPS) to Railway sub-station at Diwana. It is imperative to have reliability of supply from HVPNL to avoid repercussion on railway traffic. He pointed that HVPNL takes about 15-20 minutes to arrange alternative supply from Panipat to Railway sub-station at Diwana from Safedon. This period needs to be reduced to minimize outage of supply on Delhi-Ambala route. It was pointed out that for railway supply to Diwana, HVPNL has not made exclusive feeders. Railway wants that exclusive feeder/bus be provided to them. This will increase reliability of railway supply.
 - 3.4 Railway representative opines that 132 kV D/C PTPS-Diwana line is not being cleaned properly by HVPNL. He stated that tripping and flashovers were observed on this line on 1st and 2nd Jan, 2010. Railway representative stated that this line falls in the polluted zone and needs immediate attention to avoid flash-overs.
 - 3.5 It was informed that Railways is executing work to provide alternate supply for Diwana sub-station from NTPCs, Dadri sub-station. This was considered to be a good alternative. The group is of the opinion that in order to have long term reliability of supply, Railways may explore options to have more feed points to their network.

4.0 Visit of 400KV substation at Muradnagar

- 4.1 Muradnagar S/S has been commissioned in 1978/79. There are 5 nos. of 400 kV lines emanating from Muradnagar namely Panki, Dadri, Agra, Moradabad & Muzaffarnagar. It has 3 nos. of ICT (2 X 240 MVA and 1 X 315 MVA). Most of the equipments have been in the service for over about 30 years and have become old & obsolete and need replacement with new equipment.
- 4.2 It was observed that multiple tripping occurred on the following lines emanating from Muradnagar during year 2009, details of which are given below:
 - a) 400 kV Agra - 47 times
 - b) Muzaffarnagar- 30 times
 - c) Muradabad - 7 times
 - d) Panki - 11 times
 - e) Dadri - 4 times
- 4.3 **Replacement of Air Blast circuit Breaker (ABCB) with SF6 CB:** The equipment was installed during 1978/79 and most of them have outlived their lives and have become obsolete. It has been informed that replacement of some important equipment such as Air Blast Circuit Breaker has already been replaced with SF6 circuit breaker and replacement of remaining ABCBs with SF6 Circuit Breakers are in progress/ process. The details are given below:

Name of feeder/ ICT at Muradnagar end	Status of Circuit breaker	Remark
400 KV Agra, Muzaffarnagar, Muradabab and Dadri	SF6	-
400 KV Panki feeder	ABCB	SF6 CB by April 2010
ICT-I/III	SF6	-
ICT-II	ABCB	SF6 CB by Nov 2010
220 KV feeders	SF6	
Bus Transfer breaker	ABCB	SF6 will be procured and replaced at the earliest

4.4 UPPTCL informed that all the electro mechanical relays on 220 kV feeders have been replaced with numerical relays. Similarly, on 400 kV feeders of Dadri, Panki & Muradabad, replacement of relays by numeric relays have been completed. The updated status is briefed below:

Sl.No.	Name of feeders	Numerical relays Provided or not	Remarks
1	400 KV Dadri	M-1, Micom numerical relay Provided	The relays have been replaced by PGCIL and their Engineers have conveyed that M-2 relays of this feeders shall be replaced by the end of April 2010.
2	400 KV Muradabad	-----do-----	-----do-----
3	400 KV Panki	Both M-1 & M-2 Numerical relays provided	-
4	400 KV Muzaffernagar		N1 Numerical relays are available and shall be replaced by the end of Feb. 2010. M-2 relays shall be procured and replaced with in a year.
5	400 KV Agra	-----do-----	-----do-----

4.5 **Differential Bus Bar protection** – The bus bar protection is of EE make (CAG) analog type and its performance is not satisfactory. The group opines that numerical/ digital Bus bar protection should be provided.

4.6 UPPTCL intimated that majority of the operating staff are on contract basis through Sainik Kalyan Samiti due to non availability of regular staff. A comparative statement showing sanctioned vs available staff is as under:

Name of the post	Sanctioned	Available
EE	1	0
AE	4	2
JE	4	3
SSO	8	4
Messengers	8	8

- 4.7 **Status of replacement of Porcelain insulators with Polymers insulators:** UPPTCL informed that no tripping had observed on the section where Polymer insulators have been provided in the vicinity of Muradnagar s/stn. Polymer insulators have been provided on some of the lines such as Muradnagar- Moradabad, Muradnagar- Muzaffarnagar (partial), Muradnagar- Panki and Muradnagar- Dadri. The group is of the opinion that since Muradnagar lies in high pollution zone, polymer insulators should be provided on all line emanating from Muradnagar sub station.
- 4.8 **Condition monitoring of equipment:** It was observed that there was no specific annual maintenance plan for condition monitoring of various switchyard equipment such as tan delta, hot spot identification etc.
- 4.9 Railway does not take any supply from Muradnagar sub-station.

5.0 Visit of 400 kV Mau Sub station

- 5.1 Mau is connected with 400 kV Anpara(S/C), Azamgarh(S/C) and Balia(D/C) sub-stations. Mau has two ICTs of 200 MVA, 400/132 kV rating. The Mau sub-station was commissioned on 31-12-1993 and all circuit breakers are SF-6 type.
- 5.2 The Protection on 400 kV Mau- Azamgarh Line is; Main-I Razfe(ABB) and Main -II -Ralda. The performance of distance protection of this line is not satisfactory. UPPTCL intimated that Ralda relay operates only when the fault is very near to Mau sub-station. Similarly the Protection on 400 kV Mau- Anpara line also Razfe and Ralda relays are provided. This existing protection is analogue type and needs replacement, with numerical relays as its performance is not satisfactory.
- 5.3 UPPTCL intimated that they have been allotted two numerical relays which would be retrofitted on Azamgarh line by Feb 2010. Apart from this, two more relays have been requested for replacement in Anpara line at Anpara end. The Group opined that UPPTCL may replace all the distance protection relays (Main-I & Main-II) with numerical relays.
- 5.4 Also the bus-bar protection at Mau sub-station was not commissioned for want of inter connection design. The Group recommends that a new bus-bar protection (numerical type) may be installed by UPPTCL.
- 5.5 Mau sub station has experienced two blackouts in the month of Jan, 2010. The first was on 13th Jan at 0343 hrs and second on 15th Jan at 0556 hrs. UPPTCL intimated that during the incidents of 13th Jan and 15th Jan 2010 on Mau-Azamgarh line, the distance protection relay did not detect the fault and the fault was cleared from Balia sub-station of POWERGRID. The logic unit of Razfe relay was found faulty and was set right by UPPTCL. No fault was further reported. The Group opined that Balia feeders are provided with numerical relays so the DR feature might also be configured and activated at Mau end. POWERGRID was requested to help Mau operating staff in this regard. POWERGRID agreed to assist UPPTCL. A test DR printout from the Balia lines after configuration at Mau end would be submitted to NRPC secretariat by 28th Feb, 2010.
- 5.6 UPPTCL intimated that event logger(S-900) was installed on 9-3-2003 and became non-functional due to problem in power module. The Group recommends that new event logger may be provided at Mau sub-station. The DR was also provided in Nov, 93 and is also non-functional. The

Group recommends that the DR feature may be activated in numerical relays which UPPTCL plans to install in near future and configure the same and submit a test print out to NRPC secretariat.

- 5.7 Regarding frequent fault of 400 kV Anpara-Mau Line, - UPPTCL intimated that this line contains some BHEL make, 1992 batch porcelain insulators which were giving problem very frequently. They have observed that when insulator string is replaced with new string the performance improves. The Group recommends that all the BHEL make (1992 batch porcelain insulators) may be replaced and possibility may be explored to provide polymer insulator on Anpara-Mau line as this line is passing through forest area and incidents of tripping due to bird droppings is also high. UPPTCL will also provide bird-guard on towers as practiced by POWERGRID. POWERGRID will assist UPPTCL in providing design of bird-guards particularly for 'V-strings" insulators.
- 5.8 It was also observed that Mau sub station is facing high voltage problem. UPPTCL showed concern over presence of high-voltage at the sub-station. The voltage is touching up to 435 kV and is normally above 400KV. The Group recommends that a bus reactor of 125 MVAR may be provided at Mau sub-station. UPPTCL requested that a load flow study be done to establish this requirement. UPPTCL was also requested to control the load throw-off phenomena at Mau. Cutting a bulk load causes transient high voltages. UPPTCL agreed to look into the matter. Also to avoid stressing of equipment due to high voltage the Group recommends that 2 X 31.5 MVAR (33kV) bus reactors provided at Mau sub-station may be taken into the circuit immediately. UPPTCL intimated that they will bring the bus reactor back by 31st Mar, 2010.
- 5.9 It was also found that condition monitoring through tan delta analysis, hot spot detection etc is not in practice in UPPTCL. The Group recommends that tan Delta analysis of the bushing, may be done periodically. Also thermo vision camera may be procured at least at transmission circle level and annual thermo scanning to identify hot-spots should be done in 400 kV sub-stations. The Group also recommends procurement of tan delta kit under each transmission circuit.
- 5.10 It was found that Mau has ABB make ETI-21 PLCC scheme with protection coupler NSD-61. The protection coupler needs up-gradation. The protection coupler should be replaced with NSD-50 type. The Group observed that the voice communication was also not satisfactory, which should be made more reliable through PLCC.
- 5.11 The DG set and the batteries are functional.
- 5.12 The Group found that the modern testing kit is not available with T&C personnel. Without the modern testing kit, the O&M cannot be improved. It is suggested that the test equipment may be made available at sub-station or at least at each division level. The details are given in recommendations.
- 5.13 Railway presently does not take any supply from Mau sub-station. However electrification of Lucknow and Mughalsarai route is in progress and supply for the same would be taken as under:-
 1. Birpatti Railway TSS from UPPTCL Sarnath
 2. Sarai Harku Railway TSS from UPPTCL Badlapur
 3. Sultanpur Railway TSS from UPPTCL Sultanpur
 4. Sindurwa Railway TSS from UPPTCL Jagdishpur

5. Utretia Railway TSS from UPPTCL Sarojininagar, Lucknow

6.0 Recommendations

A General Recommendations

- 6.1 UPPTCL is presently employing staff through Sainik Kalyan Samiti, and they may not be competent for operation of 400 kV sub stations. In order to ensure reliability, it is recommended that 400 kV sub station be manned through regular staff only. **(Time frame: 6 months)**
- 6.2 All analogue bus bar / Line distance protection should be replaced with Numerical type. **(Time frame: 6 months)**
- 6.3 Event Logger (EL) should be installed at all 400 kV sub stations and Disturbance Recorder (DR) feature may be activated in existing and new numerical relays which constituents plans to install in near future. **(Time frame: 6 months)**
- 6.4 Condition monitoring through Capacitance and tan delta measurement, hot spot detection etc should be undertaken by UPPTCL. It is recommended that tan Delta analysis of the bushing, may be done periodically. Thermo vision camera may be procured at least at transmission circle level and half yearly thermo vision scanning to identify hot-spots should be done in 400 kV sub-stations. **(Time frame: 6 months)**
- 6.5 The Group recommends that the test equipment may be made available at each sub-station or at least at each Division level:
- Electronic/ relay test kit
 - Tan- delta test kit
 - Transformer winding resistance test kit
 - Dynamic contact Resistance measurement (DCRM) & Contact Resistance Measurement (CRM) (for circuit breaker test kit)
 - Timer for circuit breaker time test
 - Gas leakage detector
 - Earth resistance meter
 - DC Leakage detector and battery discharge test kit
 - 15 kV Megger
 - Sweep Frequency Response analyzer (SFRA) in each transmission zone
 - Thermo vision camera in each transmission zone
- The Group also recommends that a testing lab at zonal level may also be established by UPPTCL

(Time frame: 9 months)

B Recommendations Specific to sub station

Panipat

- 6.6 The present practice of manual cleaning of insulators may be progressively replaced with high pressure water jet live line washing except in case where polymer insulators are provided. This concept was also recommended by the Inquiry committee constituted to inquiry into the Grid incident dated 27th Jan 2007. **(Time frame: 3 months)**

- 6.7 Haryana/ BBMB may take up the matter with National Fertilizer Ltd (NFL) and Haryana Pollution Control Board so that emissions of solid particulate matter from NFL's captive power plant can be brought within permissible limits. **(Time frame: 3 months)**
- 6.8 The inbuilt event logger in the SCADA system should be enabled so that substation engineers can view events taking place in the substation, can do internal analysis and take remedial measures, ,if required **(Time frame: within 1 month)**
- 6.9 Wherever flashover through the air has been observed, the insulators should be replaced in time bound manner. **(Time frame: 6 months)**
- 6.10 Wherever required, wiring used for protection and instrumentation should be replaced. **(Time frame: within 3 months)**
- 6.11 Possibility of looping in and looping out of 400 kV Dehar- Panipat and Dehar – Bhiwani lines at some intermediate locations may be explored to address the problem of high voltage being experienced at 400 kV Panipat bus particularly in winter season. **(Time frame: one year)**

Muradnagar Sub station

- 6.12 **PLCC related issues** –The performance of the existing protection coupler i.e NSD-61 is not satisfactory. It is recommended that protection coupler – 61 may be replaced with NSD – 50. It was found that 400 kV Agra- Muradabad line is provided with ETI PLCC which should be replaced with ETL type along with NSD – 50 protection coupler. **(Time frame- within 6 months).**
- 6.13 **Auxiliary supply** – It was found that the generator was functional but the operating staff need training for its operation. The group recommends that AMF panel for auto operation of the generator may be provided. The AMC of the generator may be outsourced as UPPTCL is having shortage of operating personnel. It was found that batteries of the auxiliary system were replaced during 2001. The group recommends that the same may be replaced within 6 months. **(Time frame - within 6 months).**
- 6.14 **Spare availability** – The group recommends that the following spares may be kept at Muradnagar sub station.
 1 pole of each circuit breaker of each type
 1 no. each of CT, CVT, LA etc. **(Time frame - within 9 months).**
- 6.15 **Provision of CCTV on sub station** – The design of sub station is such that the view of the sub station is not available from the operators position. The group recommends that CCTV may be installed in the switch yard. **(Time frame - within 6 months).**
- 6.16 **SPS for ICTs** – UPPTCL may arrange special protection scheme (SPS) to avoid tripping of all three ICTs on overloading. Scheme may be such that radial feeders may be tripped when the loading on ICTs exceeds permissible limits. **(Time frame - within 6 months).**

Mau sub station

- 6.17 BHEL make (1992 batch)porcelain insulators provided at 400 kV Anpara-Mau line may be replaced and possibility may be explored to provide polymer insulator on this line as the line is passing through forest area and incidents of tripping due to bird droppings was observed. **(Time frame - within 9 months).**
- 6.18 UPPTCL should also provide bird-guard on towers as practiced by

POWERGRID. POWERGRID will assist UPPTCL in providing design of bird-guards particularly for 'V-strings' insulators provided at 400 kV Anpara- Mau line. **(Time frame - within 6 months).**

- 6.19 The DR feature in 400 Balia- Mau line at Mau end should be configured and activated. POWERGRID had agreed to assist UPPTCL. A test DR printout from the Balia lines after configuration at Mau end would be submitted to NRPC secretariat by 28th Feb, 2010. Similarly DR feature may be activated in numerical relays which UPPTCL plans to install in near future. **(Time frame - within 6 months).**
- 6.20 The Group recommends that a bus reactor of 125 MVAR may be provided at Mau sub-station. Also to avoid stressing of equipment due to high voltage it is recommended that 2 X 31.5 MVAR (33kV) bus reactors already provided (but not in service) at Mau sub-station should be taken into the circuit immediately. UPPTCL intimated that they will bring the bus reactor back by 31st Mar, 2010. **(Time frame - by 31st March 10).**
- 6.21 The PLCC protection coupler NSD-61 should be replaced with NSD-50. Also voice communication should be made more reliable through PLCC at Mau sub station.**(Time frame - within 6 months).**

C Recommendations for improving supply to Railway

- 6.22 Separate/ exclusive feeder for railway Grid station should be arranged at PTPS/ Safedon station to increase the reliability. **(Time frame: Six months)**
- 6.23 Railways is executing work to provide alternate supply for Diwana sub-station from NTPC Dadri sub-station. This was considered to be a good alternative. It is recommended that in order to have long term reliability of supply, Railways may explore options to have more feed points to their network on urgent basis.
- 6.24 Appropriate action may be taken by HPVNL to reduce change over time (presently it is 15-20 min) from PTPS to Safedon station for reliability of railway supply. **(Time frame: one months)**

Acknowledgement

The Group gratefully acknowledges the cooperation extended by the officials of BBMB, and UPPTCL in the collection of information pertaining to frequent tripping at Panipat, Mau and Muradnagar sub stations.

The Group places on the record its appreciation of the assistance provided by, Shri R K Singh, Manager, POWERGRID, and Shri Vikram Singh, Executive Engineer, NRPC in helping in the analysis and preparation of the report.

Name of Member S/Shri	Signature
V. P. Trivedi, Chief Engineer, Power System, UPPTCL	Sd-
K. B. Sharma, Chief Engineer, (SO), BBMB, Chandigarh	Sd-
R. K. Garg, Chief Engineer (TS), HVPNL, Panchkula	Sd-
Ajay Talegaonkar, Director, GM Division, CEA	Sd-
Bhaskar Sharma, General Manager, POWERGRID NR-I, New Delhi	Sd-
D.K. Jain, DGM, NRLDC, New Delhi	Sd-
A representative of Railways	Sd-
SE (O), NRPC, Convener	Sd-