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भारत सरकार  
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18-ए, श.जीत सिंह मार्ग, कटवारिया सराय,  
नई दिल्ली- 110016  
Government of India  
Northern Regional Power Committee  
18-A, S. Jeet Singh Marg, Katwaria Sarai,  
New Delhi-110016

NRPC/OPR/105/11/2014

दिनांक 23.01.2014

To,

1. Director (Tech), HVPNL, Panchkula,
2. Director (O), UPPTCL, Fax – 0124 – 2578315
3. General Manager (OS), NTPC Ltd, New Delhi
4. General Manager (O&M), POWERGRID, NR-I, New Delhi
5. General Manager, NRLDC, New Delhi

**Subject:** Analysis of tripping of 400 kV Dadri-Greater Noida line and Navada-Ballabgarh line on 16.12.2013 reportedly due to over voltage.

Sir,

A meeting was held on 23<sup>rd</sup> December, 2013 on the above subject. The analysis of tripping of 400 kV Dadri-Greater Noida line and Navada-Ballabgarh line on 16.12.2013 based on the discussion and subsequent inputs from the Haryana & UP, is enclosed for necessary action.

Encl: As above

Yours faithfully,  
Sd/-  
(P.S. Mhaske)  
Member Secretary I/C

Copy for information to: Member (GO&D), CEA, New Delhi

Analysis of tripping of 400 kV Dadri-Greater Noida line and Navada-Ballabgarh line on  
16.12.2013

400 kV Dadri-Greater Noida line and 400 kV Navada-Ballabgarh line had tripped on 16.12.2013 reportedly due to high voltage. A meeting was held at NRPC, New Delhi on 23.12.2013 to analyze these tripping. List of participants is attached at Annex-1.

2. Based on discussions in the meeting and information submitted by UPPTCL, NTPC and HVPNL, it was clear that 400 kV Dadri-Greater Noida line had tripped due to error in CVT. However, reason for tripping of 400 kV Navada-Ballabgarh line was not clear. Therefore, it was decided that HVPNL would carry out testing of all the CVTs at Navada sub-station and also a team from POWERGRID would visit the Navada sub-station to analysis the issue. Based on the discussions in the meeting and reports submitted subsequently following sequence of events, reasons for tripping and remedial measures have been finalized.

3. Sequence of events:

On 16.12.2013 at 03:54 hrs, 400 kV Dadri-Greater Noida line and 400 kV Navada-Ballabgarh line had tripped on over voltage. Though DR at Greater Noida and Navada is not available, it is inferred from the Sequence of Event (SoE) data from SCADA of NRLDC, that 400 kV Dadri-Greater Noida has opened from Dadri end before the opening of 400 kV Ballabgarh-Navada from Ballabgarh end. The SoE (from Dadri and Ballabgarh stations) as recorded in NRLDC SCADA is given at Annex-II. Apart from DR/EL not being available from Greater Noida and Navada, the real time data was also not available from these stations and therefore no SoE was recorded in NRLDC SCADA. It is clear that 400 kV Dadri-Greater Noida line had opened from Dadri end but the line remained connected from Greater Noida end, as PLCC was non-functional so Direct Trip could not be extended. After tripping of these lines, no feed was available to Navada as well as Greater Noida sub-stations and there was complete blackout at these sub-stations.

4. Possible reasons contributing to tripping

4.1 The Dadri Phasor Measurement Unit (PMU) voltage plot is given at Annex-III. The PMU plot shows that the voltage at Dadri was below 440 kV. The voltage recorded at Dadri is also reported to be about 436 kV. This is definitely high voltage but not high enough to cause tripping of the line. Generally, high voltage trip setting of transmission lines is at 440 kV with time delay of 5 seconds. Though no representative from NTPC

attended the meeting, the issues was discussed telephonically with Shri PP Francis, GM (OS), NTPC and it emerged that perhaps there was slight positive error in the B-ph CVT output, which led to operation of the relay on high voltage. It was also informed that this had been taken care by modifying relay setting suitably.

4.2 It was initially suspected that tripping of 400 kV Navada-Ballabgarh line might also be due to error in CVT output. However, after the meeting, the CVTs were tested by HVPNL and the error was found to be within permissible limits. During visit of POWERGRID team to Navada sub-station, it was noted that the time delay set in stage-1 Over Voltage protection was less than 5 Seconds and as a result both the lines at Navada S/s might have tripped prior to tripping at Ballabgarh end.

4.3. Further, measurement of voltage for Main-I (Micom P442) at Navada is in phase-to-phase mode. However, it is always preferred to connect the relay with individual CVT to Neutral because Ph-Ph voltage measurement is prone to higher error as two CVTs are involved and phase angle error of both CVTs may add to enhance the measurement error.

4.4. It was noted that main-II (Micom P437) at Navada is also of same make as Main-I (ALSTOM). It is preferable to have Main-I and Main-II of different make.

4.5 It has been gathered that time delay for stage-1 O/V protection at Gr Noida end for Navada line is kept 0.5 Sec by UPPTCL. This also needs to be corrected as such tripping can again take place during high voltage condition due to momentarily rise in voltage.

## 5. Recommendations

5.1 Though the issue of CVT error has been taken care by suitably modifying the relay setting, NTPC should regularly monitor the CVT in question for error. If it shows increasing trend, the CVT should be replaced.

(Action: NTPC Ltd, Time frame: periodic)

5.2 Time delay of at least 5 seconds should be included in the over voltage protection setting for stage-I. Further, there should be grading of the O/V stage-1 settings to avoid simultaneous tripping of lines from same sub-station on O/V stg-1 protection.

(Action: HVPNL and UPPTCL, Time frame: Immediate)

5.3 Measurements for over voltage protection should be done in phase-to neutral mode and not phase-to-phase mode. It is also noted that HVPNL has kept different O/V

time delay settings in Main-1 & Main -2 protection of the same line. Accordingly following changes in O/V relay setting are recommended at Navada S/s:

For Micom P442 relay, setting of Overvoltage protection may be kept as under:

V> Measur't Mode: Phase-Neutral  
V>1 Voltage Set : 70V for Ballabgarh line  
                  : 71V for Gr. Noida line  
V>1 Time Delay : 5 sec for Ballabgarh line  
                  : 6 sec for Gr. Noida line  
V>2 voltage Set : 94 V i.e 150%  
V>2 Time Delay : 0.1 sec

For P437 relay the setting may be kept as under:

V> Measurement Mode: Phase-Neutral  
V>1 Voltage Set : 110% for Ballabgarh line  
                  : 112% for Gr. Noida line  
V>1 Time Delay : 5 sec for Ballabgarh line  
                  : 6 sec for Gr. Noida line  
  
V>2 voltage Set : 94 V i.e 150%  
V>2 Time Delay : 0.1 sec

The setting for 400 kV Dadri-Greater Noida line may also be done 112% for stage -1 over voltage setting both at Greater Noida and Dadri stations.

(Action: HVPNL, NTPC, UPPTCL, Time frame: 7 days)

5.4 It is advisable that Main-I and Main-II protection should be of different make. HVPNL should endeavour to shift one of the distance protections at Navada to some other sub-station and procure a distance protection of different make for Navada sub-station.

(Action: HVPNL , Time frame: 2 years)

5.5 In accordance with CEA's Grid Standards, it is mandatory to have disturbance recording and event logging facilities at generating stations and substations operating at 220 kV level or above. However, Greater Noida and Navada substations do not have such facility. These facilities should be provided in accordance with regulatory provisions.

(Action: HVPNL and UPPTCL, Time frame: 6 months)

5.6 Only one bus has been commissioned at Navada though the substation was commissioned in December 2012. This type of arrangement adversely affects reliability. HVPNL should take steps to commission second bus at Navada.

(Action: HVPNL, Time frame: 2 months)

5.7 PLCC on Dadri- Grater Noida line is non-functional for quite some time. The PLCC should be re-commissioned to enable protection related functions.

(Action: NTPC and UPPTCL, Time frame: 1 month)

5.8 The real-time data (analog as well as digital data) from Greater Noida and Navada substations should be made available at NRLDC.

(Action: UPPTCL, HVPNL, Time Frame: 1 month)

**List of Participants**

1. Shri P.S.Mhaske, SE (C), NRPC
2. Shri Ajay Talegaonkar, SE(O), NRPC
3. Shri Naresh Kumar, EE (O), NRPC
4. Shri P.N. Dixit, GM (O&M) NR-1, POWERGRID
5. Shri M.S. Hada, Dy. Manager (O&M), NR-1, POWRGRID
6. Shri Rajiv Porwal, Chief Manager, NRLDC
8. Shri Nitin Yadav, Engineer, NRLDC
9. Shri N.K. Makkar, EE, HVPNL
10. Shri Vipul Manocha, Assistant Engineer, HVPNL
11. Shri S.P. Kargati, EE, UPPTCL
12. Shri Arun P. Singh, SE, UPPTCL, NOIDA

**Annex-II**

**Sequence of Events as recorded in NRLDC SCADA**

Date	Time	substation	Device Type	Device name	Status change	Quality	
'16-12-2013	'03:54:26.475	D_THM_NT	CB	(F_20)MANDUALA-2 GNODA T	OPEN		
'16-12-2013	'03:54:26.476	D_THM_NT	CB	(F_21)GNODA MAIN BUS-1	OPEN		
'16-12-2013	'03:54:32.004	BALLABGARH	CB	F_19 D_THM2 MAIN BUS-2	BETWEEN	Bad	Valid
'16-12-2013	'03:54:32.014	BALLABGARH	CB	F_17 GNODA TIE	OPEN	GOOD	Valid

**Dadri Voltage plot**

