



भारत सरकार
Government of India
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
पश्चिम क्षेत्रीय विद्युत समिति



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Western Regional Power Committee

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दिनांक : 21.07.2016

Date: 21.07.2016

सेवा में / To

As per List (सूची के अनुसार)

विषय : 127वीं रक्षण समिति की बैठक की कार्यसूची।

Sub : Agenda notes for 127th Protection Committee Meeting.

महोदय / Sir,

इस पत्र के साथ दिनांक 27 | 07 | 2016 एवं 28 | 07 | 2016 को 11:00 बजे, कॉन्फ्रेंस हाल, प. क्षे. वि. स , एमआइडीसी मरोल, अंधेरी पूर्व, मुंबई में होने वाली, रक्षण समिति की 127वीं बैठक की कार्यसूची आपकी सूचना एवं आवश्यक कार्रवाई हेतु संलग्न है।

Please find enclosed herewith Agenda Notes for the 127th Protection Committee Meeting of WRPC to be held on 27.07.2016 & 28.07.2016 at 11:00 Hrs at Conference Hall, WRPC, MIDC Marol, Andheri (E), Mumbai-400 093. This is for your information and necessary action.

You are requested to make it convenient to attend the same.

The Agenda notes for the meeting is available on website www.wrpc.gov.in, same may please be downloaded.

भवदीय / Yours' faithfully,

(Satyanarayan S)

अधीक्षण अभियंता (रक्षण) / Superintending Engineer (Protection)

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**AGENDA OF 127th PROTECTION COMMITTEE MEETING OF WRPC
TO BE HELD ON 2016 AT WRPC MUMBAI**

ITEM NO.1: CONFIRMATION OF MINUTES OF 126th PROTECTION COMMITTEE MEETING

The minutes of 126th PCM, held on 02.02.16 and 03.02.16 at WRPC, Mumbai were circulated vide WRPC letter No. WRPC/Protection/126 PCM/20156/ dated **12.04.2015**.

No comments were received.

Committee may like to confirm the minutes of 126th PCM.

ITEM 2: OCCURANCES/GRID DISTURBANCES:

A. OCCURANCES IN GUJARAT SYSTEM

2.1. Grid Incidence at 400kV Asoj Sub-station on 27th December 2015

On 27th December 2015, at 12:37 Hrs, HV bushing of Y-phase unit of 500 MVA 400/220 kV ICT 1 flashed and caught fire at 400/220 kV Asoj Sub-station. Due to this, ICT-1 tripped on differential R, Y, B phase, Buchholz, and PRV protection from HV side whereas inter trip from LV side. The NIFPS operated correctly and Y phase unit was protected very safely from complete fire. There was no load/generation loss during the event.

The 400 KV Asoj- Chorania-2 and 400 KV Asoj SSP line tripped from opposite ends and 400 KV Asoj- Vadodara-1 tripped from Asoj end only. These operations are mal operations and to be investigated.

ICT no 1 spare single phase unit taken into service in place of failed Y ph unit after carrying out necessary jumper work in HV, LV and Tertiary side. The spare phase bushing CT wiring, stability test taken and the ICT-1 was taken into service at 16.42 hrs, 400 KV Chorania-2 is taken into service at 13.09hrs and 400kv Vadodara -1 is taken into service at 13.35 hrs on 29/12/15. 400kv SSP was taken into service at 11.01hrs on 30.12.2015. The detailed report received from WRLDC is enclosed in **annexure 2.1**.

Committee may like to discuss.

2.2. Grid Incidence at HVDC Mundra Sub-station on 8th January 2016

Due to Lightning arrester failure of pole 2 in the Mohindergarh DC yard caused fault in DC line, both poles of HVDC Mundra Mohindergarh got blocked. This led to operation of SPS related with the HVDC Mundra Mohindergarh causing tripping of APL Mundra Unit 7 & 9 and reduction in Unit 8. This caused loss of generation in tune 1004 MW in western region. Further as per SPS action, more than 1200 MW load loss occurred in Northern region. The event occurred due to the foggy weather in the northern region. The pole 2 was restored at 11:20 and pole 1 at 11:29 Hrs. The details received from Mohindergarh end is attached as **annexure 2.2**.

Committee may like to discuss.

2.3. Grid Incidence at 400kV Ranchoprura Sub-station on 28th December 2015

On 28.12.15, at 6.57 Hrs R phase CT of 400 kV CGPL make Bus coupler at 400/220 kV Ranchoprura substation burst which created bus fault on 400 kV Bus 1 and Bus 2 causing bus bar protection operation. This resulted in tripping of all 400 kV lines and 400/220 kV ICTs from Ranchoprura S/s. No Load/Generation loss occurred during the event as 220 kV remain intact during the event.

Most of the elements are restored by 09:35 hrs. The failed R-Phase C.T is replaced with the new C.T on 29.12.15. The detailed report received from WRLDC was enclosed in **annexure 2.3**.

Committee may like to discuss.

2.4. Grid Incidence in South Gujarat due to fog on 26th February 2016:

On 26th February 2016, in between 02:00hrs and 07:00 Hrs, due to dense fog in the south Gujarat, several lines were tripped on insulator flashover and arcing faults. However there was no interruption in any of the area with these tripping.

The details of trippings and restorations of various elements are as follows

220 kV Kosamba-Utran circuit 1:

This circuit tripped at 02:21 Hrs and remain out due to permanent nature of fault. Test charge was taken at 03:27 hours from Kosamba end, but line tripped again on Z-1 on Y Phase to E/F. At Location number 90(S), B phase insulator string was found flashed over and same was replaced. At 18:33 Hrs, line trial charge was again taken from Kosamba end, but it tripped on Z1, Y phase to E/F. At loc. No. 80 (S), Y phase insulator string was found in flashed

over condition and same was replaced. Finally the line was charged at 08:43 Hrs.

220 kV Kosamba-Vav circuit:

R phase to E/F occurred on circuit at 02:24 Hrs and it got successfully reclosed. Further at 02:28 Hrs, Y phase to E/f occurred on the circuit and its A/R was successful. At 02:41 Hrs, Initially Y phase fault appeared which was at 14.5 kA with fault current of 8.17 kA. The circuit got successfully reclosed. After this with in next 7 seconds fault is reappeared in R phase, With this the circuit tripped. After patrolling it was found that at Location No. 90(S) R phase string and at Location No. 124 (S) Y phase string were found in flashed over condition. These were replaced and circuit was taken in service at 14:51 Hrs.

220 kV Kosamba-Kim circuit 2:

This circuit tripped on R phase to E/F with relay indication as Kosamba end: Zone1, R Phase to E/F, Kim end: Zone 1, R Phase to E/F, Based on the PMU plot it was observed that auto-reclosure has not operated on the circuit from one end or either end. The circuit was taken in service at 08:48 Hrs after patrolling. PMU plot is enclosed in annexure.

220 kV Sugan-Kim circuit 1:

Y phase to E/f occurred on this circuit. No Details were received from the utility. This line was taken in service at 04:20 Hrs.

220 kV Kawas-Dastan:

R phase to E/F occurred on 220 kV Kawas-Dastan circuit. The fault was of permanent nature and lines were charged after completion of rectification work. No Details were received from NTPC and GETCO.

400 kV Sugan-Zhanor circuit:

This circuit experienced Y phase to earth fault and successful A/R operated. DR for the same is attached as annexure.

220 kV Sugan-Kim circuit 2:

R phase to E/F occurred in circuit at 03:34 Hrs. Circuit was taken back in service at 04:20 Hrs.

220 kV Kosamba-Kim 1:

R phase to Earth fault occurred on the circuit at 03:34 Hrs due to insulator string flashover. This was replaced and circuit was taken back in service at 11:38 Hrs.

400 kV Kosamba-Asoj circuit: R phase to E/F occurred on the circuit and after one second it got successfully reclosed.

220 kV Kosamaba-GSEG 1:

At 04:19 Hrs, B phase to Earth fault occurred on 220 kV Kosamba-GSEG 1 circuit.

A/R was not observed. At location No. 4 (T) Y Phase Jumper found open which was attended. Line was taken at 16:32 Hrs due to issue with GSEG end breaker.

400 kV Kosamba-Asoj and 400 kV Kosamba-Choronia:

Y phase to Earth fault occurred on 400 kV Kosamaba-Asoj circuit and A/R was not Successful with this line tripped. Circuit was taken in service 04:54 Hrs. This line restored at 15:42 Hrs due to rely reset problem in Kosamba S/S.

220 kV SLPP Bus 2, 220 kV SLPP-Jhagadia circuit and 220/6.9 KV 15/25 MVA ST-2 SLPP:

B phase to earth fault occurred during the tripping of these elements. No further details received from the utilities and SLDC.

220 kV SLPP-Gavasad 1:

This circuit tripped on R phase to earth fault at 04:50 Hrs. It was taken back in service at 13:40 Hrs.

220 kV Kosamba-Suva:

This circuit tripped on R phase to E/F and no A/R was observed. No further details obtained from SLDC and utility.

220 kV Kosamba-Gavasad 1:

R phase to earth fault occurred on this circuit at 05:21 Hrs. No A/R is observed. Line was taken in service at 05:45 Hrs.

400 kV Kosamba-Ukai (T) 2:

R phase to E/F occurred on the circuit at 06:03 Hrs. No A/R was observed. After thorough patrolling, line was charged at 16:39 Hrs.

220 kV Kosamba-Gavasad 1:

R phase to earth fault occurred on this circuit at 06:26 Hrs Hrs. No A/R is observed. Line was taken in service at 06:54 Hrs.

132 kV Bharuch-Ankleshwar 2:

B phase to earth fault occurred at 07:11 Hrs. Line was taken in service at 11:39 Hrs.

220 kV Kakrapara-Haldarwa 2:

Y phase to E/F occurred on the circuit at 07:29 Hrs. No A/R is observed. At location No. 209 (DS), Y phase insulator string found flashed over. Same was replaced by PGCIL and line was taken back at 20:45 Hrs.

The detailed report received from WRLDC is enclosed in **annexure 2.4**.

Committee may like to discuss.

B. OCCURANCES IN MADHYA PRADESH SYSTEM

2.5. SPS OPERATION FOR GWALIOR-AGRA ON 14 JAN 2016

Due to foggy morning weather in the Northern region, 765 kV Gwalior –Agra D/C tripped on 14 Jan '16 on two occasions causing SPS operation.

The Event started at 07:10 hrs onwards. First B phase to Earth fault occurred on 765 kV Gwalior- Agra circuit 1 at 07:10:52 Hrs and the circuit successfully reclosed after 1 second. SOE shows that Main CB reclosed after 1 second while tie after 2 second.

At 07:14: 31 Hrs B phase to E/F occurred on 765 kV Gwalior-Agra circuit 1 and Y Phase to E/F on circuit 1. After one second of A/R period, Circuit 1 successfully reclosed while Y phase fault persisted on circuit 2 causing its tripping. SOE shows that Main CB reclosed after 1 second while tie after 2 second.

At 07:30: 36 Hrs Y-B phase to phase fault occurred on 765 kV Gwalior-Agra circuit 1 and it is tripped. With this tripping there was a simultaneous reduction of import by NR on 765 kV Gwalior Agra 1 & 2 by more than 1500 MW resulting in its SPS operation. This led to tripping of 220 kV Gwalior-Malanpur D/C and SPS signal for generation reduction at CGPL/Korba/Vindhyachal.

Backing down occurred in Western region generating station is as following:

1. Korba (Unit 7) : 167 MW
2. VSTPS(Unit 9,10) : 311 MW
3. CGPL (All units): 138

Total: - 616 MW against 1000MW envisaged.

Trial attempt were taken however the fault persisted and line tripped once again. The line2 was taken in service at 12:15hrs and Line 1 at 12:25 hrs.

At 22: 57 Hrs Y phase to earth fault occurred on 765 kV Gwalior-Agra circuit 1 and it got successfully auto-reclosed.

At 23: 02 Hrs B phase to earth fault occurred on 765 kV Gwalior-Agra circuit 2 and when auto-reclosed the fault persisted and line tripped.

At 23: 08 Hrs R phase to earth fault followed by Y phase to earth fault occurred on 765 kV Gwalior- Agra circuit 1 and line tripped. With this tripping there was a simultaneous reduction of import by NR on 765 kV Gwalior Agra 1 & 2 by more than 1500 MW resulting in its SPS operation. This led to SPS signal for generation reduction at CGPL/Korba/ Vindhyachal. The tripping signal to 220 kV Gwalior-Malanpur D/C were blocked prior to that. However this

time no generation reduction occurred at CGPL/Korba/Vindhyachal, resulting in stress in the grid.

Circuit 1 was restored on 15 Jan 2016 at 10:52hrs and circuit 2 at 20.02hrs. The detailed report received from WRLDC is enclosed in **annexure 2.5**.

Committee may like to discuss.

2.6. Grid Incidence at 400/220 kV Indore Sub-station on 20th January 2016:

On 20th January 2016, at 01:59 Hrs, R phase to Earth fault occurred on 400 kV Indore-Nagda circuit due to insulator failure. With this A/R got initiated in the circuit. However within next 350 ms of breaker opening its LBB has operated causing tripping of 400 kV Bus 1 and all connected element along with the bus coupler. Accordingly DT was send to remote end of lines and intertrip to ICT.

There was no load interruption during the period. Most of the elements are restored by 03.11hrs expect 400KV Indore – Nagda which is restored at 16.26hrs. The detailed report received from WRLDC is enclosed in **annexure 2.6**.

MPPTCL may give the reasons for operation of LBB.

Committee may like to discuss.

2.7. Grid Incidence at 765/400 kV Jabalpur PS on 24th December 2015

On 24th December 2015, at 05:00 Hrs, 765/400 kV ICT 1 & 2 at Jabalpur Sub-station tripped on over flux protection. This resulted in isolation of 765 kV and 400 kV Jabalpur Pooling Station Bus. Immediately voltages were checked by operator and everything was found in order and site was advised to check overflux protection.

After this ICT1 was restored by 06:41hrs and ICT2 was restored by 07:01 Hrs. The detailed report received from WRLDC is enclosed in **annexure 2.7**.

MPPTCL may give the status on the testing of over flux protection.

Committee may like to discuss.

2.8. Grid Incidence at 400 kV Vindhyachal Sub-station on 28th December 2015

On 28th December 2015, at 02:29 Hrs while withdrawal of the Vindhyachal Unit 8, its breaker got stuck and LBB operated resulting in tripping of Vindhyachal Bus section 4 along

with its elements 400 kV Vindhyachal-Jabalpur 2, Vindhyachal-Satna 2, Korba-Vindhyachal, Bus Reactor 2 and IBT 1. During the event there was no load/generation loss.

Restoration started after checking of yard and resetting of relays. Bus Section 4 was taken in service by closing Bus sectionalizer CB at 06:32 Hrs and all elements were restored by 07:10 Hrs. The detailed report received from WRLDC is enclosed in **annexure 2.8**.

Committee may like to discuss.

2.9. Occurrence at 400/220 kV Bina MP Sub-Station:

On 15th January 2015, while shifting 400//200 kV ICT 3 at Bina (MP) at 15:33 hrs from 220 kV Main Bus 1 to 220 kV Bus 2, 220 kV Bus 2 side isolator of 400/220 kV has led to current mismatch/ load Impedance in phases resulting in tripping of all the ICTs and Incoming 220 kV lines on E/F indication.

This led to loss of supply at 220 kV and nearby area Load Loss was approx. 475 MW, 315 MWH and duration of outage was approx. 40 Minutes.

Frequency rises from 50.043 Hz to 50.107 Hz i.e. by 0.056 Hz. Power number observed during the event was 8482 MW/Hz.

Most of the elements are restored by 16:52 hrs and the rest of elements by 17:45 hrs. The detailed report received from WRLDC is enclosed in **annexure 2.9**.

Committee may like to discuss.

2.10. Grid Incident at 220 kV Sidhi and Rewa Sub-Station, Madhya Pradesh on 12th February 2016

Three events have occurred at 220/132 kV Rewa and 220/132 kV Sidhi sub-station between 12th and 13th February 2016.

On 12th February 2016, at 18:58 Hrs Event 1 occurred, at 22:12 Hrs Event 2 occurred and on 13th February 2016, at 00:23Hrs Event 3 occurred.

Event 1

This event was initiated at 18:58 Hrs due to the failure of 33 kV Circuit breaker of 132/33 kV 20MVA ICT (GEC Make) at 220/132/33 kV Sidhi Sub-station. The fault on 33 kV was reflected through this ICT on 132 kV as well as from parallel 132/33 kV 40 MVA ICT (BHEL Make). The ICT protection i.e. backup O/C and E/F relay has operated and master trip was generated at 132 kV side however breaker did not trip. Further the parallel ICT of 40 MVA has not tripped on sensing the fault. This led to fault being sensed continuously by 132 kV Lines and 220/132 kV ICT from Sidhi. The 220/132 kV Sidhi ICT tripped on Circulating current relay

operation while the 132 kV Sidhi- Sagra (Rewa 2) tripped on backup E/F protection. The 132 kV Rewa-Mangawan circuit tripped from Rewa end on distance protection. With this incoming supply to 132 kV bus at Sidhi Sub-station failed causing loss of 132 kV and radial connected loads. (132 kV Sidhi, Mauganj, Deosar, Katra and Maganwan S/s).

The system was restored by 19:45 Hrs by taking lines/ICT in service.

Load loss was 173 MW for one hour 45 Minutes during this event. The energy unserved during this event was 74 MWhr.

Event 2:

At 22:12 Hrs, 220 kV Sidhi-Amarkantak circuit tripped on B phase to earth fault and at the same time 220 kV Rewa-Birsinghpur circuit tripped from Birsinghpur due to over load on backup O/C protection. This led to failure of supply to 220 kV Rewa and Sidhi S/s causing blackout at these sub-station.

The load loss was 301 MW for duration of 1 hour leading to energy unserved of the amount 301 MWhr.

The supply was restored at 22:42 at Rewa and 22:51 Hrs at Sidhi Sub-station. Gradually other elements were taken in service.

Event 3:

The Event 2 again got repeated at 00:23 Hrs on 13th February 2016 causing loss of supply to 220/132 kV Rewa and 220/132 kV Sidhi Sub-Station. During this event, load loss in tune of 326 MW has occurred for 30 minutes duration. The quantum of energy unserved during this event was 162.8 MWhr. The supply was restored at 00:45 Hrs at Rewa and 00:34 Hrs at Sidhi Sub-station. Gradually other elements were taken in service.

The detailed report is enclosed in **annexure 2.10**.

Committee may like to discuss.

2.11. Grid Occurrence 220/132 kV Mahalgaon S/s, Madhya Pradesh on 21st February 2016

On 21st February 2016, at 06:53 Hrs, 220 kV Bina – Mahalgaon circuit (which was ideally charged from 220 kV S/s Mahalgaon end) tripped from 220 kV Mahalgaon S/s end on transient fault, resulting in operation of Bus Bar Protection. It is suspected that CT core connected to Bus Bar Protection of 220 kV Bina – Mahalgaon circuit got saturated (as intimated telephonically by Executive Engineer Testing Div. – I, MPPTCL, Gwalior), causing current unbalancing and resulting in operation of 220 kV Bus Bar Protection at 220 kV Mahalgaon S/s. With this all 220 kV elements from Mahalgaon tripped due to single main transfer bus scheme. This led to blackout of Mahalgaon, Datia and nearby connected radial load.

The amount of load loss was 302 MW and the Energy unserved during the event was 22.31 MWhr.

The restoration is carried out as follows 132 kV supply at 132 kV S/s Motijheel & 132 kV S/s Jora was resumed by charging 132 kV Sabalgarh– Motijheel Ckt & 132 kV Sabalgarh – Jora Ckt respectively at 07:03 Hrs. Thereafter supply was extended to 132 kV S/s Tigra by charging 132 kV Motijheel – Tigra Ckt at 07:03 Hrs. Supply at 220 kV S/s Mahalgaon was resumed by charging 220 kV Mahalgaon – Gwalior (PGCIL) Ckt 1 at 07:04 Hrs. rest of the elements are restored by 07:06 hrs.

The detailed report is enclosed in **annexure 2.11**.

Committee may like to discuss.

2.12. Grid Incidence at 765/400 kV Champa S/s on 27th February 2016

On 27th February 2016, at 12:52 Hrs, it was intimated by PGCIL that due to inadvertent error while carrying out wiring termination work at adjacent bay during the construction activity , the bus bar trip relay operated causing tripping of 765 kV Bus 1 at Champa S/s and associated connected elements. The elements tripping have occurred as the 765 kV Bus 2 at Champa S/s was already kept out of service without any intimation to WRLDC/NLDC. Due to tripping of all the lines, the substation went dark. The detailed report is enclosed in **annexure 2.12**.

Committee may like to discuss.

2.13. Grid Incidence at 400/220 kV Indore Sub-station on 18th March 2016

On 18th March 2016, at 01:22 Hrs, 400 kV R Phase CT of 400/220 kV 315 MVA ICT 4 got burst at 400/220 kV Indore Substation which resulted in Bus fault at the substation on 400 kV Bus 2. With this bus bar protection operated and tripped all elements connected to 400 kV Bus 2 at Indore. There was no load loss during the event. The detailed report is enclosed in **annexure 2.13**.

Committee may like to discuss.

2.14. Grid Incidence at 220/132 kV Satna (MP) Sub-station on 7th March 2016

On 7th March 2016, at around 17:10 Hrs, 132 kV Satna-Majhgawan circuit tripped on R-phase disc failure and conductor snapping. At the same time LBB protection of 132 kV Satna – Satna cement circuit Mal-operated at 220 kV Satna S/s resulting in tripping of all connected ICTs and feeders connected to 132 kV Bus at 220/132 kV Satna S/s.

Load Loss was approx. 117 MW, for about 10 min; 19.5 MWH. At 220 kV S/s Satna & supply at 132kV S/s Majhgawan was interrupted for about 6 Hrs., hence load loss at 132 kV S/s Majhgawan was about 11 MW for about 6 Hrs.; 66MWH. Thereafter 33 kV Back feed supply was taken at 23:10 Hrs. Thus total load loss was 85.5MWH.

132 kV supply at 220 kV S/s Satna was resumed by charging 220/132 kV, 160 MVA Areva X'mer at 220 kV S/s Satna at 17:13 Hrs, and most of the elements are restored by 17:20 Hrs. Failed R-phase disc of 132 kV Satna – Majhgawan Ckt was replaced and Ckt charged at 11:10 Hrs, on 08.03.2016.

The detailed report is enclosed in **annexure 2.14.**

Committee may like to discuss.

2.15. Grid Incidence at SSP 220 kV CHPH sub-station on 22nd December 2015

On 22nd December 2015, at 08:45 hrs, due to operation of pilot wire differential protection scheme of 220 kV RBPH-CHPH line 1, circuit got tripped resulting in loss of outgoing line from 220 kV Bus 1 of CHPH (220 kV bus coupler was in open condition). This led to tripping of 220 kV Bus 1 and connected unit 1, 3, 5. The generators tripping led to loss of generation to the tune of 81 MW. Units 1, 3, 5 are restored at 09:15 hrs, 09:45 hrs, 10:10 hrs respectively.

The detailed report is enclosed in **annexure 2.15.**

Committee may like to discuss.

Grid event at 220/132 KV Birsinghpur (Pali) S/s on 28th February 2016

On 28th February 2016, at 03:12 hrs, Y phase CT of 220 KV Bus coupler between Bus 1 and 2 at 220 KV Birsinghpur (pali) got burst. This created a bus fault in the system on both the buses. With this, all the connected lines / ICTs from 220 KV Birsinghpur (Pali) substation tripped, and lead to complete blackout of the station. Further, due to voltage dip and three phase fault, unit 3 and unit 4 of Birsinghpur Thermal Power Station also tripped.

There was about 306 MW of generation loss and 50 MW of load loss with this event. Most of the elements are restored 07:30 hrs.

The detailed report is enclosed in **annexure 2.32.**

Committee may like to discuss.

C. OCCURANCES IN MAHARASHTRA SYSTEM

2.16. Detailed report of the occurrence at 220/33 kV Halkarni Sub-station on 13th December 2015

Halkarni sub-station is having a single bus scheme. On 13th December 2015, at 15:40 Hrs, R phase CT of 220 kV Halkarni-Mahalaxmi line burst at 220 kV Halkarni end causing bus fault. With this the 220 kV Bus bar protection operated at Halkarni sub-station and all 220 kV elements tripped. This led to loss of Hemarus cogeneration plant and Mahalaxmi generation causing generation loss of 18.1 MW and 220/33 kV ICTs tripping leading to load loss in tune of 20 MW. Energy unserved during the event was 9 MWhr.

Most of the elements are restored by 17:30 hrs except 220 kV Halkarni-Mahalaxmi, which is restored on 14th December 2015, at 07:55 hrs. Detailed report from MSETCL is attached as **annexure 2.16**.

Committee may like to discuss.

2.17. Grid Incidence at 765/400/220 kV Sholapur (PG) and 400/220 kV Kolhapur (MS)

On 26th January 2016

On 26th January 2016, at around 18:00 Hrs, due to high frequency and Maharashtra underdrawl, the voltage at 400 kV Kolhapur touched 440 kV and 765 kV Sholapur reached above 816 KV. This led to overvoltage stage 1 pickup of lines at these stations. With this, 400 kV Sholapur-Kolhapur 2 and 400 kV Kolhapur-Karad 2 tripped from Kolhapur and 765 kV Pune-Sholapur & 765 kV Sholapur Aurangabad 1 tripped from Sholapur end. After this voltage has reduced significantly in the system and no further tripping occurred.

There was no interruption due to this in the system. The detailed report is enclosed in **annexure 2.17**.

Committee may like to discuss.

2.18. Grid Incidence at 765 kV Wardha, Aurangabad, Sholapur and Pune on 28th December 2015

While opening of 765 kV Wardha-Aurangabad 1 at 19:45 Hrs, simultaneous tripping Of 765 kV Wardha-Aurangabad 2 and 765 kV Pune-Sholapur occurred on over-voltage protection operation. This led to single circuit operation between 765 kV Buses of Wardha and Aurangabad as 765 kV Wardha-Aurangabad 3 was kept out on high voltage control. The remaining 765 KV Aurangabad-Wardha 4 was carrying more than 1800 MW during the period.

Immediately steps were taken to take 765 kV Wardha-Aurangabad 2 into service and in order to facilitate its charging 765 kV Durg-Wardha1 and 765kV Seoni-Wardha 1 were opened.

765 kV Wardha-Aurangabad 1 was restored on 29-12-15, at 07:26 hrs, 765 kV Wardha-Aurangabad 2 was restored on 28-12-15, at 22:12 hrs and 765 kV Sholapur –Pune was restored on 29-12-15, at 08:04 hrs. The detailed report is enclosed in **annexure 2.18**.

Committee may like to discuss.

2.19. Grid Incidence at 400/220 kV Bhusawal S/s on 30th December 2015

On 30th December 2015, at 18:29 Hrs, during opening of 400 kV Aurangabad-Bhusawal circuit to regulate high voltage its Y phase breaker pole at 400 kV Bhusawal end did not open causing bursting of the pole and falling of its IPS tube causing bus fault. The Bus bar protection at 400 kV Bhusawal operated for Bus 2 and all connected elements on 400 kV Bus 2 at Bhusawal tripped. During the incident there was no load/generation loss in the area.

Most of the elements were restored on 30-12-15, by 19:22 hrs, except 400kV A'bad, which was restored on 04-01-2016, at 9:10Hrs through TBC. The detailed report is enclosed in **annexure 2.19**.

Committee may like to discuss.

2.20. Grid Incidence at 400/220 kV Dhule Sub-station on 28th February 2016

On 28th February 2016, at 8:17 Hrs, 400 kV Bus bar Zone-A protection got operated at 400/220 kV Dhule substation. At the time of Bus bar protection operation there was no actual bus fault or any other external fault. Also, no switchyard operation was going on at sub-station. The bus bar protection scheme is RADSS. The Flag indication observed was "U" i.e. tripping flag. There was no phase indication i.e. either "R", "S", or "T".

This implies that the Bus bar mal-operation has occurred. The Bus bar operation led to tripping of all 400 kV Bus 1 Connected elements and Bus coupler at Dhule S/s.

At the time of restoration again bus bar protection zone-A operated at 9:39 Hrs. During this second incidence, small spark was observed in B-phase RQDA module of RADSS scheme. Also on checking RQDA module slight carbonization observed at SR/DR card of B-phase RQDA module. This was cleaned up and again bus bar protection was taken into service and normalcy was restored. During this operation, ICT-3 tripped on bus bar protection and the load got shifted on 315 MVA ICT-1 & 2 and due to this Load Trimming Scheme operated leading to tripping of 220 kV Dhule-Chalisgaon. During the incident there was no load/generation loss in the area.

The restoration of various elements is as follows, 400 kV bus coupler at 12:06 hrs, 400 kV BBLR-1 at 12:13 hrs, 400 kV Songir-1 at 12:21 hrs, 500 MVA ICT-3 at 12:25 hrs and 400 kV Khandwa-2 at 12:31 hrs. The detailed report is enclosed in **annexure 2.20**.

Committee may like to discuss.

2.21. Grid Incidence at Karad and nearby area due to Fog on 12th February 2016

In the early morning Hours on 12th February 2016, Due to fog near Karad area in Maharashtra, Many of the 400 and 220 kV lines tripped on fault. However there was no interruption in any other area in the system. Prior to the event, 400 kV Karad-Kolhapur 1, 400 kV Lonikhand-Koyna 4 and 400 kV Karad-Jaigad 2 were in open condition to control the high voltage situation in the area.

The following lines tripped during the incident 400 kV Jejuri –Koyna Stage 4, 400 kV Karad-NewKoyna 2, 220 kV Karad -Mudshingi 2, 400 kV Karad-NewKoyna 1, 220 kV Kolhapur – 5 Star 1, 400 kV Karad-Kolhapur2, 400 kV Kolhapur- Kolhapur (PG) 1, 220 kV Karad-Nigade. In many cases non operation of A/R was observed which was highly undesirable.

Trail attempt were taken on 400 kV Lonikhand-Koyna 4 circuit which was in open condition on high voltage at 06:40HRS and 07:29hrs but the line tripped on Y phase to E/F fault on both occasions. So, charging of other circuits was not attempted during for fog period. Lines were restored one by one after reduction in the fog.

Most of the elements are restored by 15:52 hrs, and the rest of the elements are restored by 18:35 hrs. The detailed report is enclosed in **annexure 2.21**.

Committee may like to discuss.

2.22. Grid Incidence at 400/220 kV Padghe S/s on 10th December 2015

On 10th December 2015, at 09:00 Hrs, At 400 kV Padghe s/s, 400 kV Padghe-Babhaleshwar-I circuit was under outage for Line & S/s bay Equipment maintenance works from 09:03 Hrs on 10th December 2015. After completion of the maintenance works, all work permits were cancelled at both ends. After cancellation of Cross Permit, Earth isolators were opened at both ends and then Bus-1 isolator along with line isolator were closed at Padghe end. However at the very same instance heavy sparking observed at Y phase CB pole causing bursting of Y pole of CB Burst at Padghe end. Hence, in order to avoid the possible bus fault, bus 1 isolator of 400 kV Padghe- Babhaleshwar-1 line at Padghe end was opened. While opening this bus 1 isolator, heavy arc was observed on its Y-phase which created Bus 1 Fault this led to tripping of all the lines & ICT's on Bus 1 on Bus bar protection operation. As 400/220 kV ICT 1 & 2 which were

on Bus 1 tripped leading to overloading of 400/220 kV ICT 3 and 4. This resulted in load trimming scheme operation for ICT.

The Load loss due to Load trimming scheme operation was 364 MW for duration of about 45 minutes. The energy loss was in tune of 311 MWhr.

400kV Main Bus I charged through bus coupler at 20:05HRS. Most of the elements are restored by 20:58 hrs, except 400 kV Babbleshwar-1(Through TBC) and 315 MVA 400/220/33 KV ICT-2, which were restored at 23:18hrs and 23:49hrs respectively. The detailed report is enclosed in **annexure 2.22**.

Committee may like to discuss.

2.23. Grid Incidence at 765/400 kV Pune GIS S/s on 16th December 2015

On 16th December 2015, at 11:03 Hrs, auxiliary switch of 2nd Stage gas detector alarm of 400 kV Pune Parli 2 89 A compartment got earthed resulting in its operation causing tripping of 400 kV Main Bus 1 and connected all elements. During the event there was no fault in the system. There was no load/generation loss during the event. All the elements are restored by 11:54 hrs. The above incident is one of the first at GIS sub-station. The detailed report is enclosed in **annexure 2.23**.

Committee may like to discuss.

2.24. Grid Incidence at 765/400 kV Sholapur (PG) Sub-station on 2nd January 2016

On 2nd January 2016, at 18:22 Hrs, 765 kV Sholapur-Raichur 2 line reactor tripped on REF protection operation during its charging at Sholapur end as a bus reactor after completion of its AMP work (Line was out due to jumper snapping). At the same time 765 kV Aurangabad-Sholapur 1 line reactor at Sholapur end also tripped on REF. This led to high voltage at Sholapur sub-station.

Again at 19:56 Hrs, 765 kV Sholapur-Pune 1 and 765 kV Aurangabad-Sholapur 1 circuit tripped on overvoltage from Sholapur end. This led to reduction in the system reliability in the area. However there was no further tripping. Lines/reactors were taken immediately after the voltage improvement at Sholapur.

765 kV Sholapur-Raichur LR at Sholapur end (Charged as Bus reactor) at 21:03 Hrs. 765 kV Aurangabad Sholapur 1 LR @ Sholapur end restored on 03-01-2016 07:11hrs. 765 kV Sholapur-Pune was restored by 21:26 hrs. 765 kV Aurangabad Sholapur 1 was restored on 03-01-2016 at 07:11hrs. The detailed report is enclosed in **annexure 2.24**.

Committee may like to discuss.

2.25. Grid Incidence due to Tripping of 765 kV Aurangabad-Sholapur 1 & 2 on 1st March 2016

On 1st March 2016, at 22:05 Hrs, 765 kV Aurangabad-Sholapur D/C tripped on Fault. This has resulted in loading of parallel 400 kV networks. Further, the voltage in the Maharashtra's system has reduced considerably due to the tripping of these circuits. It was observed that the largest angular separation in between Trissur and Vindhyachal crossed 100 degrees from initial 77 degrees due to these tripping. This event was of serious concern however with system operator's actions the event has been contained. There was no load/generation loss during the event. The reason for the various SPS non-operation is provided in the annexure.

The 765 kV Sholapur-Aurangabad 1 was taken back in service at 22:38 and 765 kV Sholapur-Aurangabad 2 at 23:03 Hrs. The detailed report is enclosed in **annexure 2.25**.

Committee may like to discuss.

2.26. Grid Incidence at 400/220/100 kV Kalwa S/s on 11th March 2016

On 11th March 2016, at 02:25 Hrs, 220/22 kV 50 MVA ICT 1 of CGPL Make at 220/100 kV Kalwa substation caught fire and tripped on Differential Relay and Buchholz/PRV trip operation. Due to fumes, flame and fire in the ICT, the adjacent 220 kV Kalwa-AKP bay R-phase wave trap also burnt and uncoiled, creating R phase to Earth fault in the system. The line fault due to wave trap burning was sensed at Kalwa in Zone 1 and operated correctly however R pole restriking occurred causing LBB operation after 200 ms. This led to tripping of 220 kV Bus section 2 and connected elements on LBB operation of the circuit which extended trip command through Bus bar protection. Further, Due to fumes, flame and fire, the conductor between 220 kV dummy tower outside switchyard terminating on 220 kV gantry got melted and after getting broken it rested on 100 kV Bus Y and B Phase. This created 100 kV bus fault at 220/100 kV Kalwa S/s. All the 100 kV feeders connected to creek side tripped on operation of bus bar protection at 220/100 kV Kalwa S/s.

During the incident, 400/220 kV 500 MVA ICT 1 at 400/220 kV Kalwa S/s also tripped due to burning of control cables in 220/100 kV switchyard (ICT is having arrangement that it can be taken in 220 kV bay of 220/100 kV S/s or 400/220 kV S/s).

During the event, high fault current was observed to the tune of 47.8 kA along with severe voltage dip (B phase voltage reduced from 247 kV to 126 kV) which causes load throw off. Further, the LTS scheme has also operated due cable shorting during the event which resulted in additional load shed. Most of the elements were restored on 11.03.2016, by 22.57hrs.

It was intimated that the complete sub-station repair due to the above damage was done on war footing basis within 15 days. The detailed report is enclosed at **annexure 2.26**.

Committee may like to discuss.

2.27. Grid Incidence at 220 kV Nasik GCR Sub-station on 18th March 2016

On 18th march 2016, at 14:30 hrs, due to DC leakage, the Bus bar protection for 220 kV Bus section 3 of Nasik GCR sub-station got operated. This led to tripping of 220KV Nasik-Bableshwar 2 and Nasik Unit 5. Tripping of Unit has resulted in loss of generation 140 MW.

Bus section 3 was restored by 14:54 hrs, 220KV Bableshwar was restored by 15:06 hrs, and GT 5 was restored by 19:07 hrs. The detailed report is enclosed at **annexure 2.27**.

Committee may like to discuss.

2.28. Grid Incidence at 765/400 kV Koradi III Sub-station on 29th March 2016

On 29th March 2016, due R phase CT failure of Main Bay of 765 kV Koradi 3-Tirora ckt 2 at Koradi 3 S/s, its bus bar protection operated. This led to tripping of all Main CB of Bus 1 and operation of the carrier aided line protection of the 765 kV Koradi 3-Tirora ckt 2 from both ends. This led to fault isolation. After 1 second the A/R on the line operated, however due to permanent nature of fault, the line also tripped. There was no generation/load loss during the event. Line was charged after isolation of 710 Bay at Koradi End at 12:46 Hrs. The detailed report is enclosed at **annexure 2.28**.

Committee may like to discuss.

D. OCCURANCES IN CHATTISGARH SYSTEM

2.29. Grid incident at 220/132 kV Urla Sub-station on 16th December 2015

On 16th December 2015, at 13:19hrs, 132 kV Y phase breaker pole of 220/132 kV ICT 2 at Urla Sub-station got burst resulting in bus fault at 132 kV bus of 220/132 kV Urla bus. After this all elements from 132 kV Urla Bus tripped resulting in load loss in tune of 300 MW in the area. The event caused loss of supply in Urla and Partial loss in area of Raipur, Industrial Sector C of Raipur, Borjhara, Heera and Kachana. Frequency has risen from 50.031 to 50.072 Hz i.e. by .041 Hz due to loss of load.

Restoration started by isolating the faulty ICT 2 and charging of other 220 kV ICTs and 132 kV Lines. ICT 1 & 3 were restored by 15:15 Hrs and gradually other lines were restored. The detailed report is enclosed at **annexure 2.29**.

Committee may like to discuss.

2.30. Grid Incidence at 400 kV Korba NTPC on 6th March 2016

On 6th March 2016, Due to interruption of Cooling tower and cooling water supply for the Korba Generation Stage 1 (Unit 1,2,3) and Stage 2 (Unit 4,5,6), these units tripped at 06:36 hrs and 06:47 hrs. This led to loss of generation 435 MW at 06:36 hrs and 972 MW at 06:467 hrs. There was a frequency drop during stage 1 tripping (Gen Loss: 435 MW) and was 0.060 Hz i.e. from 49.967 Hz to 49.907 Hz. While in stage 2 gradual tripping of Units have occurred i.e. Unit 4 followed by unit 5 and 6 have tripped at short intervals. Frequency drop started from 49.961 Hz to 49.812 Hz i.e. by 0.159 Hz.

Restoration work was initiated, at 07:20 hrs, Tie Transformer-2 was charged and downside CW/CT system was normalized. After this, most of the units are synchronised by 14:32 hrs, except unit 2 which was synchronised on 07.03.2016, at 15:26 hrs. The detailed report is enclosed at **annexure 2.30**.

Committee may like to discuss.

2.31. Grid Incidence at Raipur Sub-station due to inclement weather on 18th March 2016

Due to inclement weather with rains and wind at Raipur Sub-station and its nearby area, 400 kV Raipur-Sipat2, Raipur-Korba 3 and 400 kV Raipur-JPL 1&2 tripped on various indications. Among these three lines (400 kV Raipur-Sipat2, 400 kV Raipur-JPL 1&2) have tripped on fault in the line section while Raipur-Korba 3 line in the teed protection.

400 kV Raipur-JPL 1&2 are restored 16:59 hrs and 18:49 hrs respectively, 400 kV Raipur-Korba 3 by 18:34 hrs. 400 kV Raipur Sipat 2 was restored on 19-03-16 at 15:05hrs. The detailed report is enclosed at **annexure 2.31**.

Committee may like to discuss.

ITEM NO. 3: Tripping of lines / ICTs :

The minor incidences of tripping of lines and ICTs during the **period 01-12-2015 to 31-03-2016** are enclosed at **Annexure-3**.

All utilities shall furnish the single line trippings & minor trippings to WRPC and indicate whether A/R is provided at both ends of the line or not. Also it shall be reported as to whether the A/R operation was successful for transient faults or not and whether A/R is locked out for permanent faults on the lines or not. Constituents shall provide A/R availability/status for each line at both ends.

Committee may like to discuss/note.

ITEM No. 4 : Multiple tripping of evacuation lines at CGPL(Leading to tripping 4x830 MW generators) and 400 kV lines at 400 kV Bachhau S/S.

All the feeders were in service at Bhachau S/s except 400kV Bhachau Versana#1&2 which were out of service due to operation of Busbar Protection at Versana end at 20:29hrs (Bus#1) and 21:49hrs (Bus#2) Both these lines (Versana Bhachau#1&2) remain charged from Bhachau end. At 22:49, these lines were hand tripped from Bhachau end. Therefore 400kV Versana buses were dead. However the 220kV system at Versana was intact. At 02:37hrs, in order to charge the 400kV Bus at Versana through 400 kV Bacchau-Varsana 1 while charging, the line tripped from Bacchau end in Zone -2 at 02:37:10.824. Tracking was observed on the wave trap PI and PI between CVT to LA during inspection. The fault was also sensed by 400kV CGPL-Bacchau-1 from CGPL end and the line tripped at 02:37:10.779 hrs. The 400kV CGPL-Bacchau-2 at CGPL end also sensed the fault in Zone 2 initially and later on power swing was detected. Subsequently this line tripped in zone-1 power swing. All the other lines emanating from CGPL tripped in Zone-1 power swing along with the units at CGPL on out of step.

A meeting was held at PGCIL Vadodara on 18.07.2016 to look into the matter and following observations were made:

- (i) After a bus fault usually of the nature of tracking on insulators, comprehensive inspection and cleaning of insulators should be carried out and after ensuring proper care, the decision for charging the bus be taken.
- (ii) A dead bus after bus fault should not be charged through a short line. Also the dead bus should not be charged through a line having strong source at the other end. It should generally be charged through a long line or through ICTs, so that the fault currents are less.
- (iii) The Zone 2 settings adopted by CGPL for all the lines, at CGPL end is 300msec and the remote end settings are 350msec. The adoption of 300msec for Zone 2 at CGPL end is in view of stability of generating units and critical clearing time of faults. It was noted that the 400kV Bacchau-Versana-1 & 2 lines are very short lines(8.5kM). The group suggested that PGCIL may adopt 250msec for 400kV Bacchau-Versana-1 & 2 and CGPL may adopt 350msec for time being, and afterwards based on the studies for stability of the generators for faults to be carried out, it would be decided to raise the zone 2 time settings for these lines.
- (iv) The DPS operation at Bacchau end of 400kV Bacchau-Versana#1 was in order since the fault was at the Versana gantry. The 400kV CGPL- Bacchau-1 sensed the faults in Zone 2 at CGPL end due to short line length of 400kV Bacchau-Versana.

- (v) It was suspected that the power swing has set up during or with the fault on 400kV Bacchau-Versana-1 and subsequently all the lines from CGPL tripped in Zone-1 power swing. The units also tripped simultaneously on OST.

A report would be prepared with further studies of the DRs

The details of trippings are enclosed at Annexure-4.

Committee may like to discuss.

ITEM NO. 5: Hon'ble CERCs orders on the Grid disturbance of 30.07.2012 &

31.07.2012

5.1: Compliance Status observations made in Protection Audit (Petition No. 220/MP/2012) Back Ground :

Back ground :

CERC vide its order dated 21.02.2014 in respect to petition No. 220/MP/2012 filed by POWERGRID have directed that CTU and SLDCs shall submit quarterly Protection Audit Report to the respective RPC latest by 15th day of the first month of next

quarter and RPCs shall submit the report to the Commission latest by 15th day of the second month of next quarter. The Member Secretary of Regional Power Committees shall monitor the protection related issues and bring to the notice of the Commission any instance of non-compliance of the Regulation 1.5 of the Grid Code in respect of the protection related issues considered in the instant petition.

The compliance status of observations made during protection audit was reviewed in detail in a special meeting held on 18.12.2014. In this special meeting it was observed that as per the data available with WRPC, few observations made in the protection audit were not pertaining to protection system deficiencies (neither Category A nor Category B) but were of system improvement related. Hence it was decided that all observations of protection audit would be classified as protection system related i.e. Category A, Category B & system improvement related observations, would be furnished separately and shall not be included in the list of category A or B deficiencies.

A special meeting was held on 16.02.2016 to discuss the above issue. **The updated position in the above meeting is enclosed at Annexure-5.**

All the constituents/Utilities are requested to submit the updated status in the meeting.

Committee may like to discuss.

5.2: Grid Disturbance on 30.07.2012 & 31.07.2012 (Petition No. 167/Suo-Motu/2012) Back

ground : Hon“ble CERC“s vide order dated 22.02.2014 in the matter of grid disturbance occurred on 30.07.2012 & 31.07.2012 in petition No. 167/Suo-Motu/2012, have made certain observations and issued directions.

According to this order, all the RPCs have to maintain the relay settings data of all the ISTS lines and lines emanating from interface S/Ss of Utilities to ISTS (400 kV & above and 220 kV interfacing lines). Therefore all utilities were requested to submit relay setting data to WRPC/WRLDC.

In 123rd PCM committee requested all utilities to compile & maintain the data of their system for voltage level of 132 kV & above. The relay setting data in respect of all 400 kV lines and important 220 kV lines (interface lines with ISTS & lines connected to generating stations) shall be submitted to WRPC/WRLDC. Committee requested WRLDC/SLDC to collect and compile the data of all utilities under their control area and submit the same to RPC. The data has been received from MP, GETCO and Maharashtra.

PGCIL, CSPTCL, ISGS, Goa, and DD & DNH to furnish the above data immediately. WRLDC/SLDC may give the status on the above.

A special meeting was held on 16.02.2016 to discuss the above issue. **The updated position in the above meeting is enclosed at Annexure-5.**

Committee may like to discuss.

5.3: CERC Order dated 05.08.2015 on draft protocol for checking protection settings and its healthiness (Petition No. 009/SM/2015)

Back ground :

Hon“ble CERC“s vide order dated 05.08.2015 in the matter of “following up actions on the recommendations of CAC Sub-Committee on Congestion in Transmission” have considered and accepted the Sub-Committees report and recommendations on measures to reduce congestion in transmission for which actions need to be taken by CEA, NRCE, CTU, POSOCO, POWERGRID, RPCs as well as CERC.

CERC, in its above order have directed Member Secretary (RPCs) as follows;

“Protection sub-Committee of RPC should bring out protocol for checking the settings, ensuring healthiness of existing protection system and periodicity of carrying out this

exercise”.

In this regards a special meeting was held on 16.10.2015 at WRPC Mumbai. In the above meeting the existing practices followed by some of the utilities was discussed. The protocol was formulated in the 126th PCM and put up to WRP Committee for its approval.

The protocol formulated in the 126th PCM was discussed in detail in the 31st WRPC meeting and the committee approved the following:

With regard to a new element getting connected to CTU, CTU informed that they are already providing the settings. However, for lines of CTU network not constructed by POWERGRID, this role will have to be done by the line constructing entity. The revised network configuration which includes the next busses along with the line length where a change in network has taken place should be given so that testing circles can set their distance relay reaches.

a) **Protocol 1: (For overall settings)** The proposer can either be Local/Field testing Engineers or HQ and the approver for these settings can be HQ and Local/Field testing Engineers respectively. These two should be different/independent groups.

b) **Protocol 2: Review At site:** Checking and validating of the settings be **done once in a year by testing/site engineer**. OR Whenever a Grid Disturbance occurs, the relay settings of the affected station and nearby station (where protection has mal operated) be checked thoroughly.

c) **Protocol 3 : Database:** Soft copies of the settings be available at the CTU/STU HQ and the same be forwarded to SLDCs/WRLDC for voltage levels of 400kV & above and ISTS lines (of all kV levels). A database of all the above elements be maintained at WRLDC/SLDC/WRPC (in addition to being maintained by respective utilities for their systems).

d) **Protocol 4: New Elements Integration:** In case of new element to be synchronized first time, the new element entity should get the settings certified/vetted (particularly the distance relay reaches) by STU/CTU as the case maybe and forward the same to WRLDC/SLDC. The parameters/fault levels regarding the incidental system to the new elements be provided by CTU/STU as the case may be to the Utility proposing to connect the new element and the settings arrived by the Utility be got verified from CTU/STU. For this the Utility proposing to connect the new element shall approach CTU/STU as the case may be. The verified settings shall be adopted by the Utility and same shall be communicated to WRLDC/SLDC as the case may be and thereafter WRLDC/SLDC shall give permission for synchronization for such elements after completion of all other formalities required as per regulations in vogue.

e) In case of any network changes, the revised network configuration (which includes the list of adjacent busses lines and along with the line lengths of the network where a change in network has taken place) should be given to the concerned testing circles/utilities/IPPs who can then set

their distance relay reaches as per the Ramakrishna Committee guidelines. For any difficulty/ratification, the matter can be discussed in PCM forum of WRPC.

Constituents/Utilities in WR are requested to strictly follow the above protocol.

Committee may like to note.

ITEM NO. 6: Status of implementation of recommendations of Report on Grid disturbance on 30th and 31st July 2012 in WR.

Back ground: An enquiry committee was set up under the chairmanship of Chairman, CEA to enquire into the grid disturbance on 30th& 31st July, 2012 in NEW grid. As per the recommendations of this committee, all utilities/SLDCs/RLDC were required to submit updated status on implementation of recommendations made by the committee to RPC on 1st& 15th of every month and the same has to be sent to CEA by RPC by 3rd& 17th of every month.

The nodal officers responsible for submission of data to RPC were already identified and were requested to forward the data regularly for onward submission of the same to CEA/MoP. In a special meeting held on 18.12.2014, it was decided that the status shall be submitted year wise separately for FY 2012-13 & 2013-14 and the data may be furnished on quarterly basis for April – 2014 onwards. In the 123rdPCM, Committee observed that there were discrepancies or mismatch in respect to protection audit data furnished by utilities for submission to CEA in format and to CERC in format. It was opined that to have a clear picture of implemented status on above recommendations in respect of protection audit, utilities may submit the consolidated and detailed status of all 132 kV, 220 kV, 400 kV and 765 kV S/s. It was also felt that SLDCs and WRLDC would coordinate to get the details.

A special meeting was held on 16.02.2016 to discuss the above issue. **The updated position in the above meeting is enclosed at Annexure-6.**

Committee may like to note.

Item No. 7: Task Force report

7.1 : Report of the Task Force on Power System Analysis Under

Contingencies: Ministry of Power, GoI constituted a “Task Force on Power System Analysis under Contingencies”, in December 2012 under the chairmanship of Shri V. Ramakrishna as per the recommendation made by Enquiry Committee headed by Chairman, CEA on grid disturbances that took place in NEW grid on 30th and

31st July 2012. The terms of reference of Task Force broadly cover analysis of the network behavior under normal conditions and contingencies, review of operational philosophy of protection relays, review of islanding schemes and technological options to improve the performance of the grid. The report of the Task Force was discussed briefly in 122nd PCM and subsequently discussed in detail in a special meeting held on 18.12.2014. Thereafter the recommendations were discussed in the previous PCMs. A brief on suggestions given by Ramakrishna Committee, discussions/observations of the group and PCM are as follows.

1) Review & correction of relay settings:

Zone-1 PSB: The task force recommended to trip if power swing enters Zone – I Characteristics and block tripping for other zones during power swing.

Decision in PCMs : All existing relays may not have feature of delayed tripping for one zone & blocking for other zones i.e. delayed tripping for Z-I and blocking for Z-II & Z-III, hence all utilities shall instantaneously trip for Zone – I power swing and block the tripping for power swing in other zones(Z-II & Z-III). Specific stations where this is not possible may be identified and put up in the next PCM.

In the 125th PCM & 126th PCM, PGCIL, MPPTCL, CSPTCL, GETCO and MSETCL representatives intimated that their settings(PSB) are in line with above recommendation.

NTPC representatives intimated that power swing is blocked for 2 secs for all 3 zones i.e. Z-1, Z-2 & Z-3 and if power swing still persist the relay will trip for all 3 zones.

NTPC may update the status on the above.

2) Formulation of Special groups for studies and protection coordination:

The Task Force recommended forming a group for studies, protection coordination and relay settings. It also recommended that each utility should establish a protection application department with adequate man power & skills. The members of protection team shall undergo regular training to enhance their skills.

Contingency and Stability Studies: The Task Force recommended to form a special group to analyze the grid conditions and factors affecting its operation and simulation of critical system conditions expected for forthcoming season on regular basis

and suitable operational strategy worked out.

Tuning of power electronic devices & PSS: The Task Force recommended carrying out studies & reviewing the network at regular intervals (3-4 years) with introduction of newer power electronic devices. The results may be implemented within next 3-4 years. It also suggested that as this requires specialized dynamic modeling, the task may be entrusted to reputed independent agency and implementation of tuning be entrusted to respective manufacturer.

Decision of PCM: It was decided that MSETCL, GETCO, CSPTCL, MPPTCL, WRLDC, POWERGRID and NTPC would nominate one member from studies side and one member from protection side and send the name of the members to WRPC for carrying out studies mentioned above. It was also decided that SLDC would give PSS details format for state generators, WRLDC for IPPS and NTPC for their generators.

SE (protection), WRPC intimated that in view of the above decision, a group was formed and a meeting of the group was held at WRPC on 22.04.2015. Following was decided in the meeting;

(i) **Operational & Off line Studies:** It was decided to update the PoC Q4 case of 2014-15 with the actual network and set this as a starting point. All utilities would furnish the bi-monthly data of planned network, planned generation and anticipated load generation for the period upto March 2016. The study group after updating the network and receipt of the forecast data would take up the operational planning studies.

(ii) **Transient Stability & Short circuit Studies:** Utilities would furnish the machines transient data of their system, wherever data is not available the same shall be assumed as per CEA/CBIP manuals. Training on the same could be arranged with IIT-B.

It was decided that two subgroups could be formed to look into the above recommendations. One subgroup would be headed by Shri R H Satpute, SE (Testing Division – Vashi). This sub group would review the protection system in WR and coordinate the relay settings as per the Ramakrishna recommendations. The other subgroup would be headed by Shri Satyanarayan. S, SE (P&S), WRPC. This subgroup would carry out studies required for coordination of relay settings.

iii) In house training:

Task force strongly recommended that a dedicated group is required to be trained in all utilities to carry out computer aided studies for relay settings. It was felt that knowledge sharing sessions / discussions, in house training on the fundamentals of load flow

studies, contingency studies, stability studies etc., may be shared with the system study engineers of utilities of WR.

iv) Training by IIT: In order to build a strong team of WR in specialized areas of studies, training sessions may be arranged to team members at IIT Bombay on relevant specialized areas subjects like transient stability, PSS tuning, tuning of FACTS devices, SSR etc.,

vi) On line studies & State Estimation: An update on the online studies (Online state estimation and contingency rankings etc) being carried out by utilities was updated as regards to packages available with them and online studies conducting at their end.

WRLDC representative informed that in compliance to recommendation 10.1.2 of Rama Krishna committee on Task Force on Power System Analysis under Contingencies, WRLDC is operating Real Time Security Desk in Control Room since June'14 with an officer conversant with system studies through PSS/E software and knowledge of SCADA/EMS.

Presently WRLDC and SLDCs are upgrading the SCADA/EMS system. In this new SCADA / EMS system complete network model of Western Region would be incorporated which would result in effective utilization of State Estimation in real time. In the upgraded SCADA/EMS, the plan is to run state estimation along with contingency analysis in real time and integrate PMU data with new SCADA/EMS system which would improve observability of network.

MSETCL representative intimated that earlier MSETCL was carrying out online studies on Seimens State Estimator software but due to increase in network complexities and constraint with existing S/W package, these studies were discontinued. It was intimated that very soon MSETCL would be shifting to new S/W package, through which online studies could be carried out.

GETCO, CSPTCL & MPPTCL representatives intimated that they are not performing online studies.

A special meeting was held on 16.02.2016 to discuss the above issue. **The updated position in the above meeting is enclosed at Annexure-5.**

7.2 : Meeting for appointment of consultant-A to conduct the study/analysis to ensure secure and reliable operation of national grid:

In compliance to MoP order dated 16.07.2014, the process of appointment of consultants

to conduct the study/analysis to ensure secure and reliable operation of national Grid, has been undertaken by CEA. A meeting to decide the data/inputs for the consultants was held at CEA on 22.05.2015 under the Chairmanship of Member (GO &D), CEA.

Following issues pertaining to protection and system studies and actions required by RPCs and constituents were discussed in the meeting:

(i) The Grid Study Committee will be chaired by Member (GO&D), CEA. GM,NLDC, POSOCO will be the convener. MS RPCs will be the members. One STU from each region would be nominated as member for the committee on rotational basis.

(ii) Identification of 25 nos of critical S/Ss in WR (already audited) for review of protection audit and setting of protection relays thereof. The consultant would carry out Protection Audit and review the protection philosophy adopted.

(iii) Substation wise protection audit reports in respect of all the substations audited in the FY 2012-13.

(iv) Nomination of nodal officers from all power sector entities. A CE level officer from each STU shall be appointed by each State/UTs to co-ordinate with SLDCs. Monthly meeting will be held on VC.

From WR, CE, STU, MSETCL was nominated for the grid study committee. WRLDC identified 25 critical S/s (already Audited) of WR and the same were forward to Grid Study committee, CEA.

Accordingly M/s Tractable was appointed as consultant. A meeting of WR constituents was held on 12.08.2015 at WRPC, to collect the data required by the consultant. The consultant M/s Tractable commenced the work under Task-I in August 2015. 256 S/S protection audit reports were forwarded to M/s Tractable and they have completed the scrutiny the protection audits reports for these S/Ss. **The Task-II for review of protection audit and protection relays thereof for 25 critical S/Ss commenced in December 15 and they have almost completed the Task-II and have recommended revisions in setting of the stations where protection audit has been carried out by them.**

Committee may like to discuss.

ITEM NO 8: COMMISSIONING OF NEW SYSTEM PROTECTION SCHEMES IN CONNECTION WITH SYNCHRONIZATION OF SR AND NEW GRID

8.1: Back ground: As per NLDC's letter dated 11.04.2014, the backing down quantum for generators in WR were finalized for various security threats after NEW – SR synchronization with 765kV Raichur-Sholapur Ckt-I. The matter was further deliberated in the 26th WRPC meeting held on 21.06.2014 and decided that as and when the signals are extended to the newer generators, the quantum of backing down of the already participating generators will be reduced on prorata basis. NLDC vide letter dated 07th July 2014 communicated modification in SPS in view of commercial operation of 765kV Raichur-Solapur ckt-II.

8.2 :Revision in SPS : With commissioning of 765kV Kolhapur-Kudgi (PG) D/C (initially charged at 400kV), revision of SPS and the present status of implementation of the SPS by various agencies involved was communicated by NLDC vide letter dated 23.12.2015.

The modifications suggested are as follows:

| S.No | SPS name | Existing SPS settings (interim arrangement) | Existing SPS action | Proposed revision in SPS | Proposed SPS actions in WR |
|------|----------------------------------|---|---|--|--|
| (A) | (B) | (C) | (D) | (E) | (E) |
| 1 | SPS-1 (Both lines in service) | Total flow on 2*765kV Sholapur-Raichur >2500MW for 5 secs. In S'pur-->Raichur direction | 800MW b/d. : JPL-150MW; JPL Extn-150MW, KSK-100MW, Lanco-100MW, DB Power-100MW, KWPC-100MW, BALCO-50MW, NSPCL-50MW. | Total flow on 2*765kV Sholapur-Raichur >3500MW for 5 secs. In S'pur->Raichur direction | 800MW B/D in WR. -Already implemented. |
| 2 | SPS-1 (Both lines in service) | Total flow on 2*765kV Sholapur-Raichur >3000MW for | 800MW b/d. : JPL-150MW; JPL Extn-150MW, KSK-100MW, Lanco-100MW, DB Power- | Total flow on 2*765kV Sholapur-Raichur >4000MW for | 800MW B/D in WR. -Already implemented. |

| | | | | | |
|---|-------------------------------------|---|---|--|--|
| | | 2.5 secs. In S'pur-->Raichur direction | 100MW, KWPC-100MW, BALCO-50MW, NSPCL-50MW. | 2.5 secs. In S'pur-->Raichur direction | |
| 3 | SPS-1 (Only one line in service) | 2*765kV Sholapur-Raichur S/C>1500MW for 2.5 secs. | 800MW b/d. : JPL-150MW; JPL Extn-150MW, KSK-100MW, Lanco-100MW, DB Power-100MW, KWPC-100MW, BALCO-50MW, NSPCL-50MW. | 2*765kV Sholapur-Raichur S/C >2000MW for 2.5 secs. | 800MW B/D in WR. -Already implemented. |
| 4 | SPS-1 (Only one line in service) | Total flow on 765kV Sholapur-Raichur S/C >1500MW in S'pur-->Raichur direction-Instantaneous | This setting is already blocked. | | |
| 5 | SPS-3 | Loss of 765kV S'pur-Raichur lines carrying 800MW towards SR | No action in WR | Loss of 765kV S'pur-Raichur lines carrying 1500MW towards SR | No action in WR |

| | | | | | |
|---|-------|--|---|--|--|
| 6 | SPS-4 | 400kV Raipur-Wardha either ckt >850MW for 2.5sec or Tripping of one ckt>=700MW | 800MW b/d. : JPL-150MW; JPL Extn-150MW, KSK-100MW, Lanco-100MW, DB Power-100MW, KWPC-100MW, BALCO-50MW, NSPCL-50MW. | SPS to be blocked | 800MW b/d. : JPL-150MW; JPL Extn-150MW, KSK-100MW, Lanco-100MW, DB Power-100MW, KWPC-100MW, BALCO-50MW, NSPCL-50MW. Also addl 200-300MW LS in Western Maharashtra. |
| 7 | SPS-5 | 400kV Wardha-Parli either ckt >850MW for 2.5sec or Tripping of one ckt>=700MW | 800MW b/d. : APL Tirora-200MW; Koradi-70MW, Chandrapur-250MW, Mauda-100MW, Khaparkheda-150MW, IB-30MW. | Tripping of one ckt of 400kV Wardha-Parli D/C and flow on other circuit>750MW. | 800MW b/d. : APL Tirora-200MW; Koradi-70MW, Chandrapur-250MW, Mauda-100MW, Khaparkheda-150MW, IB-30MW. Also addl 200-300MW LS in Western Maharashtra. |
| 8 | SPS-6 | 400kV Parli-Sholapur either ckt >800MW for 2.5sec | 800MW b/d. : JPL-150MW; JPL Extn-150MW, KSK-100MW, Lanco-100MW, | Flow on either of 400kV Parli-Sholapur D/C >800MW for 2.5sec or | 800MW b/d. : JPL-150MW; JPL Extn-150MW, KSK-100MW, Lanco-100MW, |

| | | | | | |
|---|--|--|---|---|--|
| | | or Tripping of one ckt>=700MW | DB Power- 100MW, KWPC- 100MW, BALCO- 50MW, NSPCL- 50MW. | Tripping of one ckt>700MW | DB Power- 100MW, KWPC-100MW, BALCO-50MW, NSPCL-50MW. Also addl 200- 300MW LS in Western Maharashtra. |
| 9 | SPS-7 (Only one line in service) | 765kV Raichur- Sholapur S/C >800Amps in either direction for 10secs | Trip the line | This setting is already blocked. | |

| New SPS | | | | | |
|----------------|--|----|------|--|--|
| 1 | SPS-8 (Both lines in service) | -- | ---- | Loss of import at Sholapur on 765kV Aurangabad- Sholapur D/C by more than 2500MW due to tripping of these lines. | 500-1000MW Gen B/D : JPL- 150MW; JPL Extn-150MW, KSK-100MW, Lanco- 100MW, DB Power- 100MW, KWPC- 100MW, BALCO- 50MW, |

| | | | | | |
|--|--|--|--|--|---|
| | | | | | NSPCL- 50MW. -Trip Bus reactors at 400kV Parli(PG) & 765kV Pune (PG) |
|--|--|--|--|--|---|

In the 126th PCM, WRLDC representative stated that the interim arrangement (B) & (C) suggested by NLDC have been implemented in WR and the proposed revision in SPS (D) and proposed SPS actions (E) would be reviewed once all the down stream network in SR is established, since the proposed SPS and actions are subject to establishment of the envisaged down stream network in SR. The down stream network in SR system is yet not completed and therefore this scheme may be revised by NLDC in future.

31st WRPC meeting deliberations:

WRLDC vide letter dated 16th March 2016, superseding all the previous communications in relation to the NEW-SR SPS have intimated revision in the SPS on NEW-SR corridor for implementation and is enclosed at **Annex.-8**. The SPS is summarized in the above table under column (D) & (E). PGCIL vide email dated 18.03.2016 have confirmed that all the settings under column (D) & (E) have been implemented.

WRLDC stated that all the revised NLDC SPS has been implemented except generation backing down at Maharashtra generation back down at SPS-5 and load shedding of 200-300MW in Maharashtra. Under SPS-8 the tripping of bus reactor at Pune (PG) and Parli (PG) has not been implemented since these reactors are in the same dia of other important elements as directed by NLDC/WRLDC.

CE, SLDC, MSETCL, informed that they do not agree for generation backing down at Koradi-70MW, Chandrapur-250MW and Khaparkheda-150MW for SPS-5 (Tripping of one ckt of 400kV Wardha-Parli D/C and flow on other circuit>750MW). He further informed that backing of generation at these places in Maha Genco, has not be shown to be effective. Hence he requested that these should be dropped. However as per the SPS-5 backing down at APL Tirora-200MW; Mauda-100MW, IB-30MW may be retained. Hence he requested that SPS-5 requires to be revisited. As regards to addl 200-300MW LS in Western Maharashtra, they would instead pick up generation at Koyna.

MS, WRPC informed that SPS has to be followed by all. These SPS are designed to save the grid in case of critical contingencies. GM, WRLDC informed that the chances of SPS-5 getting operated is less due to expansion of network and commissioning of Aurangabad-Solapur D/c. CE, SLDC, MSETCL informed that already the SPS for tripping of Aurangabad-Solapur D/c is there and having one more SPS-5 is not required. Hence there is a strong need revisit the SPS-5.

MS suggested that MSETCL may give their concerns to WRPC and the same would be taken up with NLDC, since the SPS has been proposed by NLDC.

Maharashtra expressed its apprehensions on the effectiveness of the SPS-5 for backing down generation in Maha Genco. MSETCL was advised to take up the matter with NLDC. Accordingly the matter was taken up by MSETCL with NLDC. The reply of NLDC is enclosed at **Annexure 8**.

Committee may like to discuss the MSETCL's apprehensions & NLDC's reply.

ITEM NO 9: IMPLEMENTATION STATUS OF SPS

9.1-a) SPS for 765 kV Bina – Gwalior – Agra: An SPS has been implemented for Bina – Gwalior– Agra D/C, wherein when sudden reduction in import by NR on Agra-Gwalior I& II ckts by more than or equal to 1500MWs, 500 MWs generation back down in WR (KSTPS NTPC– 120 MWs, VSTPS NTPC – 200 MWs & CGPL – 180 MWs) and load shedding in NR would take place.

9.1-b) Revision of SPS : NLDC vide letter dated 07th Sept. 2015 intimated that with commissioning of 765kV Gwalior-Phagi D/C & 765kV Phagi-Bhiwani, the SPS margin of 1500MW on 765kV Gwalior-Agra D/C was increased to 3000MW. Generation backing down quantum in WR increased from 500MW to 1000MW and load shedding in NR was also increased. In addition to NTPC KSTPS, NTPC-VSTPS & CGPL stations, SASAN UMPP has also been included in the SPS for a total backing down quantum of 1000MW.

In the 126th PCM, NTPC representative stated that the 330MW backing down quantum has been implemented at NTPC-VSTPS and 250MW at NTPC-KSTPS. Further, CGPL have wired up 330MW backing down quantum for this SPS with the additional condition that the generation is above technical minimum. Subsequently, the SPS signal was wired up to SASAN through PLCC channel and the backing down at NTPC-KSTPS, NTPC-VSTPS, CGPL and SASAN have been revised to 250MW.

The mock testing of the SPS was carried out on 12.05.2016 and during mock testing, a signal for loss of 1500MW was generated at Agra end and receipt of the same at VSTPS,CGPL and KSTPS was confirmed by WRLDC vide their letter dated 18.05.2016. Further it was informed that the SPS signal did not get extended to SASAN, since it was generated from Agra end which has FO connectivity.

WRPC vide letter dated 23.05.2016 (enclosed at annexure 9) took up the matter with NLDC/WRLDC as the setting for loss of import on 765kV Agra-Gwalior D/C lines, is still kept at 1500MW.

Further it was requested to confirm implementation of SPS as per NLDC letter dated 07.09.2015 and it was suggested that in case the revision in SPS is not carried out as per letter dated 07.09.2015 at Agra end, the WR generating stations, VSTPS, KSTPS, CGPL and SASAN may please be advised to set their backing down quantum to 125MW from 250 MW each(the present backing down quantum implemented for this SPS is 250MW each) and PGCIL be advised to retain the original setting of 1500MW(which at present is set at 3000MW) at Gwalior end for 765kV Agra-Gwalior D/C lines SPS.

WRLDC/POWERGRID may give the status.

ITEM NO 10: ISLANDING SCHEMES:

10.1) Islanding scheme for Sugem: In the 124th PCM, WRLDC representative intimated that a meeting was held at WRLDC, Mumbai on 16.04.2015 to finalize the islanding schemes of Sugem.

i) Islanding of Sugem: The islanding of SUGEN (Sugem generation – 2 X 387.5 MWs) with Surat load was designed and is as follows.

1. **48.5 Hz :** 220 kV Sugem-Kim D/C will be tripped
2. **48.4 Hz:** Load Generation Balance to be monitored with respect to 220 kV feeders for Surat city and generation at Sugem.
3. **48.2 Hz:** 400 kV Sugem-Pirana, 400 kV Sugem-Vapi (PG) to be opened in first Phase one by one. Fine tuning of frequency would be intimated by Sugem at the time of implementation.
4. **48.0 Hz:** 400 kV Sugem-Unosugem and 400 kV Sugem-Gandhar have to be opened in next phase one by one resulting in islanding of Sugem with Surat Load. Fine tuning of frequency would be intimated by Sugem at the time of implementation.
5. **47.5 Hz:** Instantaneous tripping of Units.

It was also decided that while synchronizing the Island with the grid, island has to be connected with 220 kV Sugan – Kim D/C (for extending supply to GSEG, Utran S/s). GETCO agreed to provide necessary synchronizing facilities at 220kV Kim S/s.

GETCO representative intimated that it has already provided necessary synchronizing facilities at 220 kV Kim S/s.

In the 125th PCM, M/s Sugan was requested to implement the above proposed island scheme at the earliest.

In the 126th PCM, Sugan representative was not present for the meeting the status could not be updated.

Sugan may update the status.

ITEM NO. 11: FOLLOW UP ITEMS:

11.1: Status of Bus Coupler and Bus Bar protections at S/s.

Back Ground: In the 118th PCM, Chairman TCC stated that the Bus Bar protection schemes should be implemented by the respective utility, without expecting the funding under R&U from MoP, GoI. In 121st PCM, WRLDC informed that BB protection at 7 Nos of 220kV S/Ss (Single Bus S/Ss) in GETCO system, 3 Nos of 220kV S/Ss in MSPGCL system, 7 Nos of 220kV S/Ss in MPPTCL system & 5 Nos of 220kV S/Ss in CSPTCL system was pending.

In 123rd PCM, GETCO representative intimated that out of 7 substations, BB protection was commissioned at 5 substations. At Limbdi substation it is under commissioning stage & expected to be completed by May, 2015 and at Navsari substation, it is in tendering stage. MPPTCL representative intimated that BB protection relays were procured and commissioning is under progress.

The updated status given by constituents is as follows;

1) **Non Availability of Bus Bar protection at 220/132 kV Bhatapara S/s:CSPTCL** intimated that busbar protection is under tendering stage.

2) **Bus Bar protection at 400/220 kV Korba West S/s:** Regarding LBB/Bus Bar protection at 400/220 kV Korba West, 200/132 kV Korba East and 220 kV Korba East Extension, CSPTCL intimated that busbar protection has been installed at 400/220 kV Korba West S/s & it is under testing. He also intimated that busbar protection relay procured for Korba east extension.

GETCO, MPPTCL and CSPTCL may update the status.

ITEM NO. 12: ANY OTHER ITEM.

ITEM NO. 12.1: Distance Protection Scheme settings at APL end on 400kVMundra-Sami lines 1 & 2 :

In the 126th PCM, PGCIL representative stated that FSC is installed on 400kV Mundra-Sami 1 & 2. However the DPS provided on the lines have not been set by factoring the FSC, this may result in over reaching of the DPS schemes and therefore APL may factor in FSC, in the settings of the distance protection schemes. APL representative stated that they are studying the mutual coupling effect on zero sequence components during the faults and after detailed study they would come up in the next PCM.

In the 126th PCM, the Committee suggested that the practice used by PGCIL, in setting the relay of lines having FSC, be adopted by APL for time being and as & when the study by APL is completed the same shall be shared by APL in the PCM for further discussions.

APL may give status.

Committee may like to discuss.

ITEM NO. 13: DATE AND VENUE OF THE NEXT MEETING

Committee may like to decide the date and venue for the next PCM (127th PCM).

Sub: Tripping at 400 KV Asoj substation on dated 27/12/2015

- (1) Name of Sub Station : 400 KV Asoj
- (2) Date & time of occurrence: 27.12.15 at 12.37 Hrs
- (3) Bus position prior to occurrence: The bus position of feeders prior to occurrence was as under. The bus coupler breaker was ON.

| <u>400 KV Bus A</u> | <u>400 KV Bus B</u> |
|---|--|
| 400 KV 500 MVA ICT 1 400 KV 315 MVA ICT 3 400 KV CHORANIA 2 400 KV VADODARA 1 400 KV INDORE 1 400 KV 50 MVAR Reactor | 400 KV CHORANIA 1 400 KV KOSAMABA 400 KV VADODARA 2 400 KV INDORE 2 400 KV 500 MVA ICT 2 400 KV SSP 400 KV WANAKBORI |

(4) Sequence of Occurrence:

- On dated 27.12.15 at 12.37 hrs, HV bushing of Y-phase unit of 500 MVA 400/220 KV ICT 1 flashed and fired.
- Due to above, ICT-1 was tripped in differential R, Y, B phase, Buchholz, and PRV protection from HV side whereas inter trip from LV side.
- The NIFPS operated correctly and Y phase unit was being protected very safely from complete fire.
- The 400 KV Asoj- Chorania-2 and 400 KV Asoj SSP line tripped from opposite ends and 400 KV Asoj- Vadodara-1 tripped from Asoj end only. These operations are mal operations and to be investigated.

(5) Relay Indications of lines/Tr./bus coupler

| Sr. No | Name of feeder/Tr. | SS end | Opposite end |
|--------|----------------------|--|-----------------------------------|
| 1 | 500 MVA 400 KV ICT 1 | HV Side: Differential RYB phase PRV, Buccholz LV Side: Inter trip | |
| 2 | 400 KV Chorania-2 | No relay No trip | Z1, Y-E , 138 Kms., 1.95 kA |
| 3 | 400 KV SSP | No Relay No trip | Z2, Y-E 65.8 Kms, 3.79KA |
| 4 | 400 KV Vadodara-1 | Breaker tripped. No Relay | No Relay No trip |

(6) Analysis:

- From DR it is seen that, maximum fault current was about 30 KA in HV Y Ph. of ICT-1. The fault is cleared within 66 msec. DR enclosed herewith.
- DGA results are abnormal and showing very high key gases but it must be due to flashing over of HV bushing which resulted into buchholz and PRV relay operation after decomposition of oil with high pressure.

| Date | H ₂ | O ₂ | N ₂ | CH ₄ | C ₂ H ₄ | C ₂ H ₆ | C ₂ H ₂ | C ₃ H ₈ + C ₃ H ₃ | CO ₂ | CO |
|----------|----------------|----------------|----------------|-----------------|-------------------------------|-------------------------------|-------------------------------|--|-----------------|-----|
| 28/12/15 | 85 | 6114 | 20598 | 115 | 146 | 13 | 60 | 25 | 1584 | 202 |

- Tan Delta results of HV and IV (220 KV) bushing is as under. These values are comparative and within acceptable limits compared to previous test results except for Y phase HV bushing and R phase IV bushing.

| Date | HV R Tan D | HV R Cap(pf) | HV Y Tan D | HV Y Cap (pf) | HV B Tan D | HV B Cap(pf) | |
|----------|------------|--------------|-------------|---------------|------------|--------------|--|
| 15.11.13 | 0.19 | 429.85 | 0.16 | 431.25 | 0.18 | 432.44 | |
| 28.08.15 | | | | | 0.16 | 433.72 | |
| 29.08.15 | | | 0.74 | 943.65 | | | |
| 30.08.15 | 0.35 | 430.55 | | | | | |

| Date | IV R Tan D | IV R Cap(pf) | IV Y Tan D | IV Y Cap (pf) | IV B Tan D | IV B Cap(pf) | |
|----------|-------------|---------------|------------|---------------|------------|--------------|--|
| 15.11.13 | 0.44 | 314.88 | 0.31 | 323.26 | 0.33 | 320.81 | |
| 28.08.15 | | | | | 0.31 | 322.26 | |
| 29.08.15 | | | 0.27 | 323.14 | | | |
| 30.08.15 | 0.84 | 315.19 | | | | | |

- Low voltage routine testing and tan delta of R and B phase were carried out and found normal except T2 tertiary bushing of B phase unit which was replaced from Y phase unit due to failure of HV bushing and kept out.
- Tan delta & capacitance value measurements were not carried out in year 2014.
- The low voltage testing, tan delta and capacitance measurement and SFRA conducted on Y phase unit of ICT 1. These results show that windings are normal. However, the HV bushing is failed, TV 2 bushing removed for providing it in Spare unit of ICT 1.

(7) Action Taken

- ICT no 1 spare phase unit is taken into service in place of failed Y ph unit after carrying out necessary jumper work in HV, LV and Tertiary side.
- The spare phase bushing CT wiring and stability test taken. The ICT-1 was taken into service at 16.42 hrs on 29/12/15.

(9) Resumption

| Sr. No | Name of feeder/Tr. | From Hrs. | To Hrs. |
|--------|----------------------|-----------|---------------------|
| 1 | 500 MVA 400 KV ICT 1 | 12.37 | 16.42 (29/12/15) |
| 2 | 400 KV Chorania-2 | 12.37 | 13.09 |
| 3 | 400 KV SSP | 12.27 | 11.01 (30/12/15) |
| 4 | 400 KV Vadodara-1 | 12.37 | 13.35 |

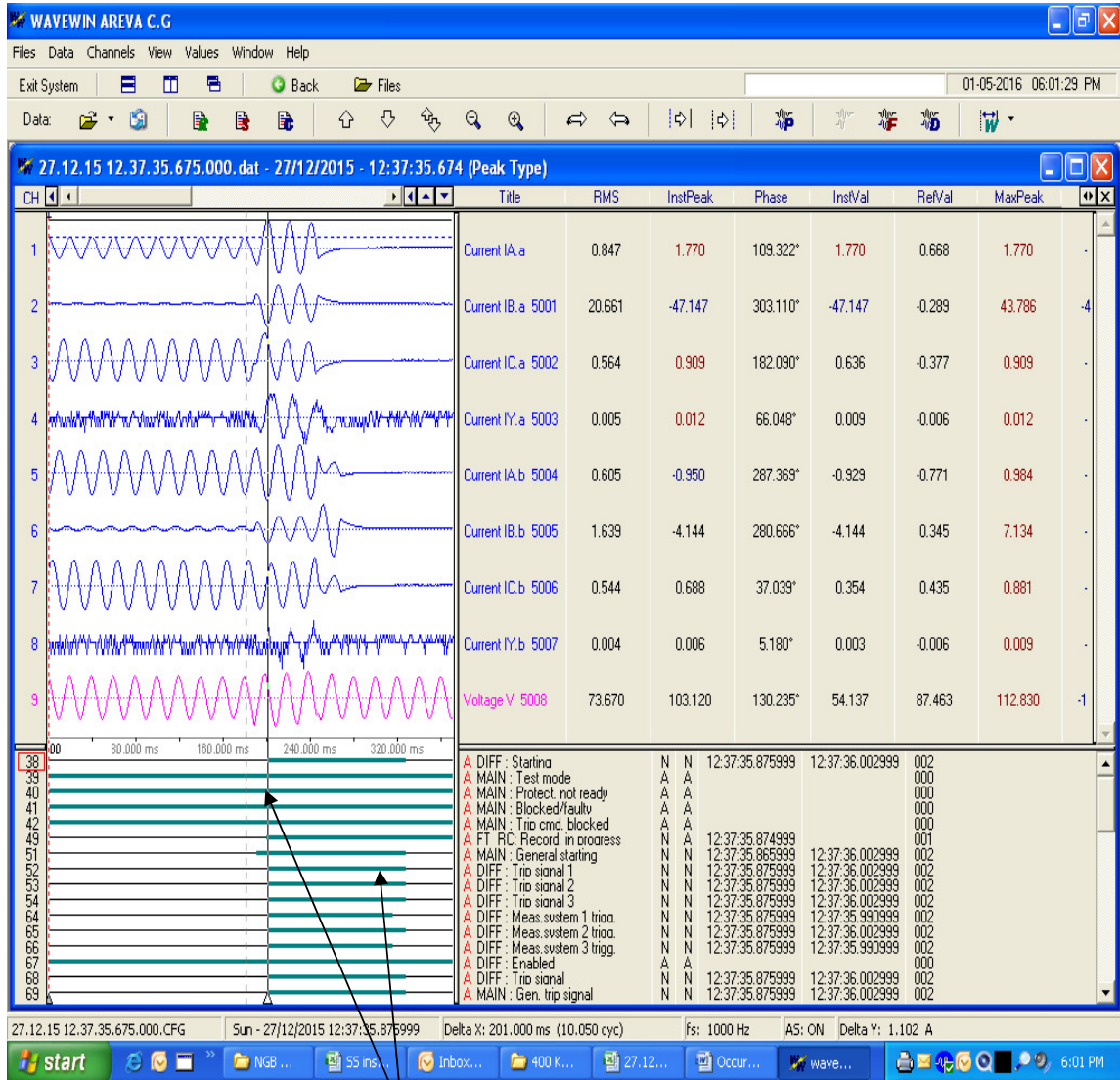
(10) Remedial Measure:

- The distance protection scheme at opposite end i.e. at SSP and Chorania is to be checked. The distance protection scheme of Vadodara -1 line at Asoj is to be checked, there is no DR recorded at Asoj. Necessary instruction for checking these relays and report before 31.01.16 is given.
- It is advisable to take Tan delta /Capacitance as per the frequency of testing and to be kept in observation through repeated testing (within 3 months) when tan delta exceeds beyond 0.7%.
- In case of high rate of rise in tan delta value and double rise in capacitance value of subject failed bushing, the field offices could have taken up the matter with corporate office for guidance or rectification which was not done.

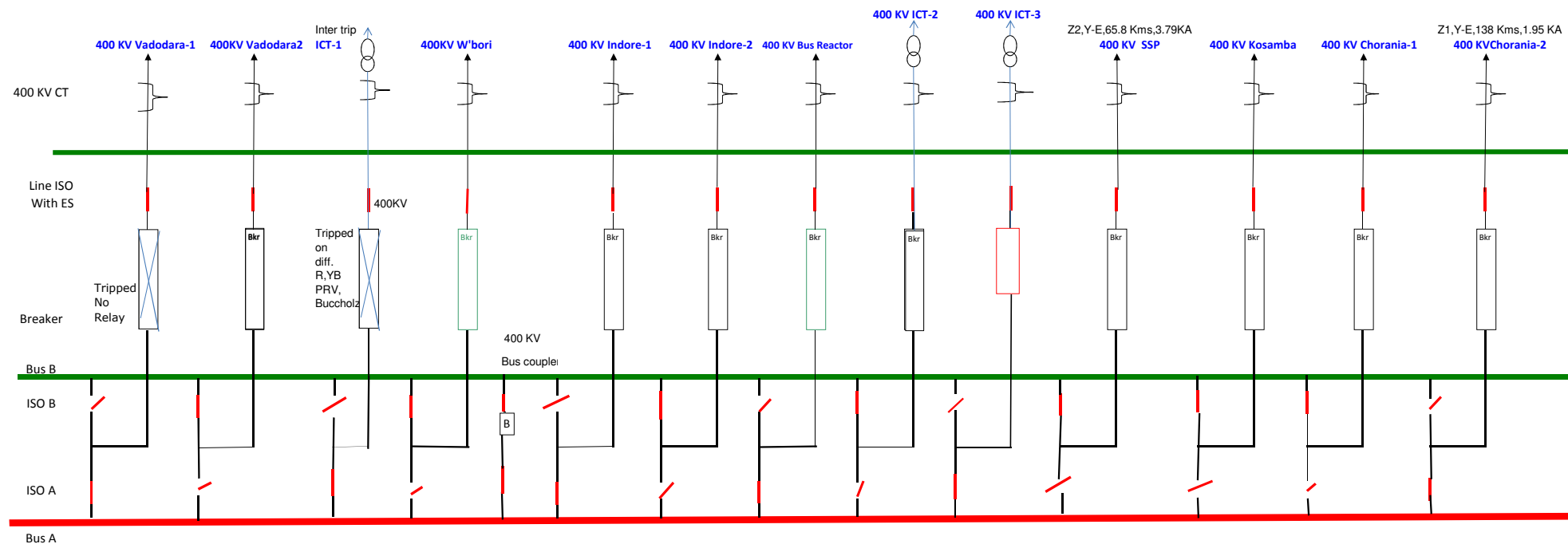
Conclusion:

- The tan delta results of bushing were not matching and capacitance deviation beyond acceptable limits on 29/8/15, which is the root cause of failure of bushing.

(A) Date & Time: 27.12.15 at 12.37.35.675, DR of ICT-1



Fault cleared around - 67 msec



Legend



Breaker Tripped



Breaker ON



C.T

Grid Incidence at HVDC Mundra Sub-station on 8th January 2016

Event Category: GI-2

Weather Related Event: Yes (Foggy weather in Northern region)

Event Date and Time: 8th January 2016, 6:40 Hrs

Event Summary: Due to Lightning arrestor failure of pole 2 in the Mohindergarh DC yard causing fault in DC line, both poles of HVDC Mundra Mohindergarh got blocked. This led to operation of SPS related with the HVDC Mundra Mohindergarh causing tripping of APL Mundra Unit 7 & 9 and reduction in Unit 8. This caused loss of generation in tune 1004 MW in western region. Further as per SPS action, more than 1200 MW load loss occurred in Northern region. The event occurred due to the foggy weather in the northern region. The various details received from Mohindergarh end is attached as annexure.

The pole 2 was restored at 11:20 and pole 1 at 11:29 Hrs.

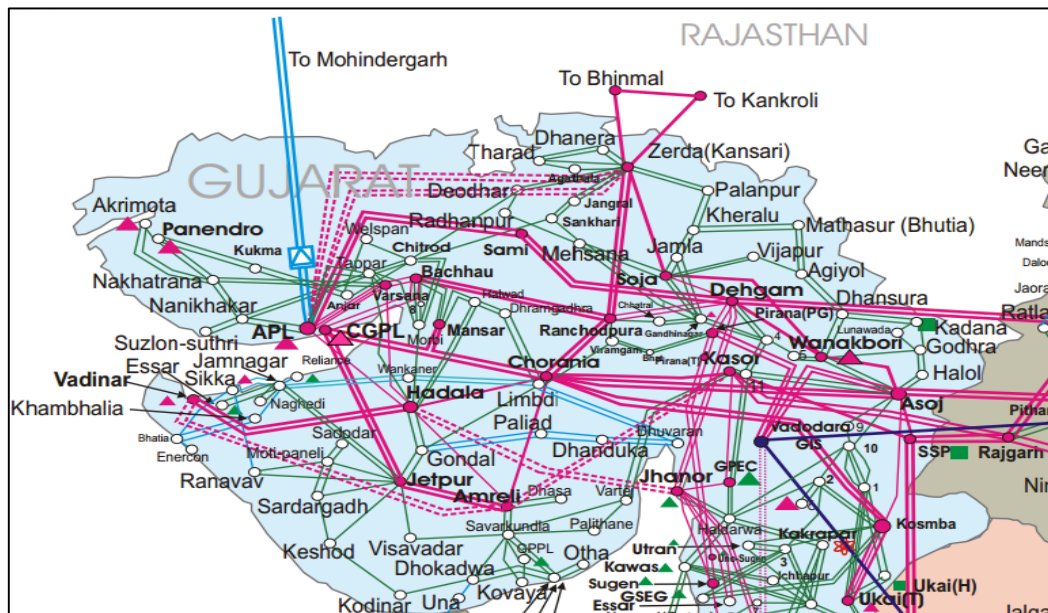


Figure 1 : Geographical Map

Remarks:

- Preventive measures for such failures may kindly be explored by ATIL.
- Also, it was seen from SPS diagram that few of the feeders in Northern region has not tripped. It is advised that routine mock testing of SPS scheme at an interval of 3-6 months may kindly be done.

Annexure: Details from Mohindergarh end.

1. Preliminary Report



Standard document no. ATL/TRN-SS/F/12

DISTURBANCE AND OUTAGE REPORT

Substation: HVDC Terminal Station, Mahendragarh

Date of Occurrence: 08/01/2016

Time of Occurrence: **06:40 hrs**

Occurrence On: HVDC P-1 & P-2

Duration of Outage: 04 Hrs 40 mins (Excluding system constraint outage)

Time of ready for charging: 11:07 hrs

The Occurrence took place during:

Normal Operation Testing Shutdown/Maintenance

Short description of occurrence:

| <u>Conditions to Tripping</u> | <u>Before</u> | <u>After</u> |
|-------------------------------|--|--|
| AC Voltage on Bus : | 422KV | 411 KV |
| Frequency : | 49.89 Hz | 49.97 Hz |
| DC Voltage : | 481 KV at P-1 & -482 KV at P-2 | 0 KVat P-1 & 0 KV at P-2 |
| Pole / Line Connected : | Pole1&2/Line 2,3,4,5 Connected | L- 2,3,4,5 Connected |
| Loading of Poles/lines : | 887 MW at P-1 & 891 MW at P-2 BH-1- 376, BH 2- 377. DH-1 - 505 DH-2 - 514 | 0 MW at P-1 & 0 MW at P-1 & P-2 BH-1-178 , BH-2 -177 DH-1- 307, DH-2 - 312 |
| Filters Status : | ACF 11,12,13,15,21,22,23,24,31,32,34 | ACF 11,12,21,22,23,31,32 |
| Weather Conditions : | Foggy | Foggy |

Any other relevant information:

Pole 1 & 2 trip due to DC Line fault and 87 EB operated. On inspection one no. of LA was found ruptured (22B11-F4) in DC yard.

Relay Flag Operated:

| At Reporting Station | At Remote Station |
|----------------------|------------------------|
| Main 1 | Main 1 |
| 87 EB | Block on other station |
| Main 2 | Main 2 |
| 87 EB | Block on other station |

Power line carrier communication status/OPGW Communication status/Back up Lease Line Communication status:

| | At Reporting (Mohindergarh) Station | | | | At Remote(Mundra)Station | | | |
|--------|--------------------------------------|----|-----------|----|--------------------------|----|-----------|----|
| | Channel 1 | | Channel 2 | | Channel 1 | | Channel 2 | |
| | Tx | Rx | Tx | Rx | Tx | Rx | Tx | Rx |
| Code 1 | OK | OK | OK | OK | OK | OK | OK | OK |
| Code 2 | OK | OK | OK | OK | OK | OK | OK | OK |
| | | | | | | | | |
| | | | | | | | | |

Enclosures: - Sequence of Events, SPS screenshot, TFR file

Signature
Soumyadeep mitra

2. Event Logger from Mohindergarh End

| WinCC Alarm Logging - RT - Short-term archive report A4 Landscape | | | | | | | | | | |
|---|--------------|--------|--------------|--|------------|--------|---------|-----|----------|------|
| Copyright © 1995-2001 by SIEMENS AG | | | | | | | | | | |
| \\WINCCPC202\WinCC60_Project_WinCC_MH\WinCC_MH.mcp | | | | | | | | | | |
| Date | Time | Number | Device | Message text | Class | Status | FCT_GRP | DLS | Duration | App. |
| 08/01/2016 | 06:35:08.906 | 234335 | 22VR80 | COMMUTATION FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:08.918 | 200213 | 21T01.L1 | TRANSF L1 AC SUPPLY FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.128 | 200213 | 21T01.L1 | TRANSF L1 AC SUPPLY FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.171 | 200216 | 21T01.L1 | TRANSF L1 LOSS OF BOTH AC SUPPLY SYSTEMS | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.205 | 200215 | 21T01.L1 | TRANSF L1 TEMP MONITORING NOT READY | MNOR | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.290 | 200218 | 21T01.L1 | TRANSF L1 COOLING SYSTEM OFF | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.291 | 200229 | 21T01.L1 | TRANSF L1 COOLER SEQUENCE LOGIC FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.345 | 203313 | 21T01 | TRANSF L1 TAP CHANGER SW MONITORING FLT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.372 | 200915 | 21X61.X1 | TFR IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.407 | 200217 | 21T01.L1 | TRANSF L1 COOLING SYSTEM ON | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.414 | 210915 | 22X61.X1 | TFR IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.427 | 200253 | 21T01.L2 | TRANSF L2 AC SUPPLY FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.458 | 261352 | 20X61.X61 | AC FILTER TFR SYSTEM IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.471 | 200256 | 21T01.L2 | TRANSF L2 LOSS OF BOTH AC SUPPLY SYSTEMS | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.497 | 200255 | 21T01.L2 | TRANSF L2 TEMP MONITORING NOT READY | MNOR | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.537 | 203295 | 21VR80 | STATUS OF OPERATION DEBLOCKED | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.597 | 200258 | 21T01.L2 | TRANSF L2 COOLING SYSTEM OFF | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.593 | 200259 | 21T01.L2 | TRANSF L2 COOLER SEQUENCE LOGIC FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:09.668 | 203314 | 21T01 | TRANSF L2 TAP CHANGER SW MONITORING FLT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:10.692 | 200269 | 21T01.L2 | TRANSF L2 COOLER SEQUENCE LOGIC FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:19.004 | 200257 | 21T01.L2 | TRANSF L2 COOLING SYSTEM ON | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:35:19.169 | 203295 | 21VR80 | STATUS OF OPERATION DEBLOCKED | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:34.016 | 235481 | 22VR80-AIDCP | TRAVELLING WAVEFRONT WFFCL-RECOVERY | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:34.017 | 234905 | 22VR80-AIDCP | TRAVELLING WAVEFRONT WFFCL-RECOVERY | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:34.022 | 234315 | 22VR80 | DC LINE FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:34.250 | 204377 | 21VR80 | 5 SECOND OVERLOAD ACTIVE | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:34.306 | 234315 | 22VR80 | DC LINE FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:34.576 | 230915 | 22X61.X1 | TFR IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:34.716 | 261352 | 20X61.X61 | AC FILTER TFR SYSTEM IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:35.095 | 200915 | 21X61.X1 | TFR IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:35.169 | 201019 | 20X71.X1 | LPL OPERATED | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:38:35.364 | 234904 | 22VR80 | CAP REDUCED BY REMOTE STATION | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.424 | 235481 | 22VR80-AIDCP | TRAVELLING WAVEFRONT WFFCL-RECOVERY | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.264 | 234905 | 22VR80-AIDCP | TRAVELLING WAVEFRONT WFFCL-RECOVERY | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.270 | 234315 | 22VR80 | DC LINE FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.602 | 234315 | 22VR80 | DC LINE FAULT | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.609 | 235511 | 22VR80-AIDCP | DC LINE UNDERVOLTAGE 270U/DT-PREWARNING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.610 | 234915 | 22VR80-AIDCP | DC LINE UNDERVOLTAGE 270U/DT-PREWARNING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.632 | 235482 | 22VR80-AIDCP | DC LINE UNDERVOLTAGE 27 DU/DT-RECOVERY | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.634 | 234906 | 22VR80 | DC LINE UNDERVOLTAGE 27 DU/DT-RECOVERY | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.634 | 235645 | 22VR80-AIDCP | ELECTRODE LINE PROT 87EB-PREMARKING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.635 | 205645 | 21VR80-AIDCP | ELECTRODE LINE PROT 87EB-PREMARKING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.635 | 235069 | 22VR80-AIDCP | ELECTRODE LINE PROT 87EB-PREMARKING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.636 | 205069 | 21VR80-AIDCP | ELECTRODE LINE PROT 87EB-PREMARKING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.639 | 205596 | 21VR80-AIDCP | TM2 SELECTED AS ACTIVE BUS | STAT | + | 0 | | 0:00:00 | |

| WinCC Alarm Logging - RT - Short-term archive report A4 Landscape | | | | | | | | | | |
|---|--------------|--------|--------------|---|------------|--------|---------|-----|----------|------|
| Copyright © 1995-2001 by SIEMENS AG | | | | | | | | | | |
| \\WINCCPC202\WinCC60_Project_WinCC_MH\WinCC_MH.mcp | | | | | | | | | | |
| Date | Time | Number | Device | Message text | Class | Status | FCT_GRP | DLS | Duration | App. |
| 08/01/2016 | 06:40:53.641 | 205018 | 21VR80-AIDCP | TM2 SELECTED AS ACTIVE BUS | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.674 | 235617 | 22VR80-AIDCP | ELECTRODE LINE PROT 87EB-BIPOL BALANCE | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.675 | 235041 | 22VR80-AIDCP | ELECTRODE LINE PROT 87EB-BIPOL BALANCE | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.676 | 205617 | 21VR80-AIDCP | ELECTRODE LINE PROT 87EB-BIPOL BALANCE | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.676 | 205041 | 21VR80-AIDCP | ELECTRODE LINE PROT 87EB-BIPOL BALANCE | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:53.628 | 230915 | 22X61.X1 | TFR IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.014 | 261352 | 20X61.X61 | AC FILTER TFR SYSTEM IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.023 | 235511 | 22VR80-AIDCP | DC LINE UNDERVOLTAGE 270U/DT-PREWARNING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.025 | 234935 | 22VR80-AIDCP | DC LINE UNDERVOLTAGE 270U/DT-PREWARNING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.177 | 200915 | 21X61.X1 | TFR IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.452 | 235794 | 22VR80-AIDCP | DC LINE DIFF 87VDCL-PREMARKING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.454 | 235218 | 22VR80-AIDCP | DC LINE DIFF 87VDCL-PREMARKING | WRN | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.472 | 234904 | 22VR80 | CAP REDUCED BY REMOTE STATION | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.519 | 235018 | 22VR80-AIDCP | TM2 SELECTED AS ACTIVE BUS | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.519 | 235596 | 22VR80-AIDCP | TM2 SELECTED AS ACTIVE BUS | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:54.576 | 263455 | 20X300-AIRPC | RPC FILTER ON INHIBIT BY U-LIMITATION | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:55.242 | 234377 | 22VR80 | 5 SECOND OVERLOAD ACTIVE | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.315 | 235042 | 22VR80-AIDCP | ELECTRODE LINE PROT 87EB-BIPOL BLOCK | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.316 | 205042 | 21VR80-AIDCP | ELECTRODE LINE PROT 87EB-BIPOL BLOCK | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.319 | 205618 | 21VR80-AIDCP | ELECTRODE LINE PROT 87EB-BIPOL BLOCK | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.322 | 235618 | 22VR80-AIDCP | ELECTRODE LINE PROT 87EB-BIPOL BLOCK | EMCY | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.336 | 263463 | 20X300-AIRPC | SELF EXCITATION LIMITATION ACTIVE | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.350 | 204354 | 21VR80 | IMAX LIMITED BY TIME OVERLOAD | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.369 | 203301 | 21VR80 | STOP SEQUENCE RUNNING | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.374 | 233301 | 22VR80 | STOP SEQUENCE RUNNING | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.465 | 203312 | 21T01 | TAP CHANGER FORCED UD10 MODE | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.470 | 233312 | 22T01 | TAP CHANGER FORCED UD10 MODE | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.736 | 263453 | 20X300-AIRPC | RPC FILTER OFF REQUEST BY U-LIMITATION | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.798 | 230915 | 22X61.X1 | TFR IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.812 | 204504 | 21VR80 | CAP REDUCED BY REMOTE STATION | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.919 | 261352 | 20X61.X61 | AC FILTER TFR SYSTEM IS RECORDING | STAT_wo_GO | # | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.928 | 263455 | 20X300-AIRPC | RPC FILTER ON INHIBIT BY U-LIMITATION | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.944 | 263459 | 20X300-AIRPC | RPC FILTER OFF REQUEST BY Q-/U-CONTROL | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:56.950 | 261441 | 20CF23-Q0 | SUBBANK CIRCUIT BREAKER OPEN | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.104 | 263459 | 20X300-AIRPC | RPC FILTER OFF REQUEST BY Q-/U-CONTROL | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.170 | 260961 | 20CF12-Q0 | SUBBANK CIRCUIT BREAKER OPEN | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.264 | 263459 | 20X300-AIRPC | RPC FILTER OFF REQUEST BY Q-/U-CONTROL | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.333 | 261041 | 20CF13-Q0 | SUBBANK CIRCUIT BREAKER OPEN | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.424 | 263459 | 20X300-AIRPC | RPC FILTER OFF REQUEST BY Q-/U-CONTROL | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.491 | 261281 | 20CF21-Q0 | SUBBANK CIRCUIT BREAKER OPEN | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.584 | 263459 | 20X300-AIRPC | RPC FILTER OFF REQUEST BY Q-/U-CONTROL | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.633 | 261361 | 20CF22-Q0 | SUBBANK CIRCUIT BREAKER OPEN | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.744 | 263459 | 20X300-AIRPC | RPC FILTER OFF REQUEST BY Q-/U-CONTROL | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.813 | 261761 | 20CF31-Q0 | SUBBANK CIRCUIT BREAKER OPEN | STAT | + | 0 | | 0:00:00 | |
| 08/01/2016 | 06:40:57.904 | 263459 | 20X300-AIRPC | RPC FILTER OFF REQUEST BY Q-/U-CONTROL | STAT | + | 0 | | 0:00:00 | |

4. SPS Event View at Mohindergarh end

| Timestamp | Event Description | Status |
|-------------------------|-------------------|--------------------|
| 08-01-2018 08:40:57.051 | C02C37D01 | SOFT SPS1 TRIP-2 |
| 08-01-2018 08:40:57.052 | C02C37D02 | SOFT SPS2 TRIP-2 |
| 08-01-2018 08:40:57.052 | C03A87D01 | SOFT SPS1 TRIP-2 |
| 08-01-2018 08:40:57.052 | C03A87D02 | SOFT SPS2 TRIP-2 |
| 08-01-2018 08:48:07.918 | C03A87D01 | COMMUNICATION FAIL |
| | | RAISED |

SPS NR MAIN BCU

SPS NR REDUNDANT BCU

SYSTEM ALARMS

SPS STAGES OPERATED

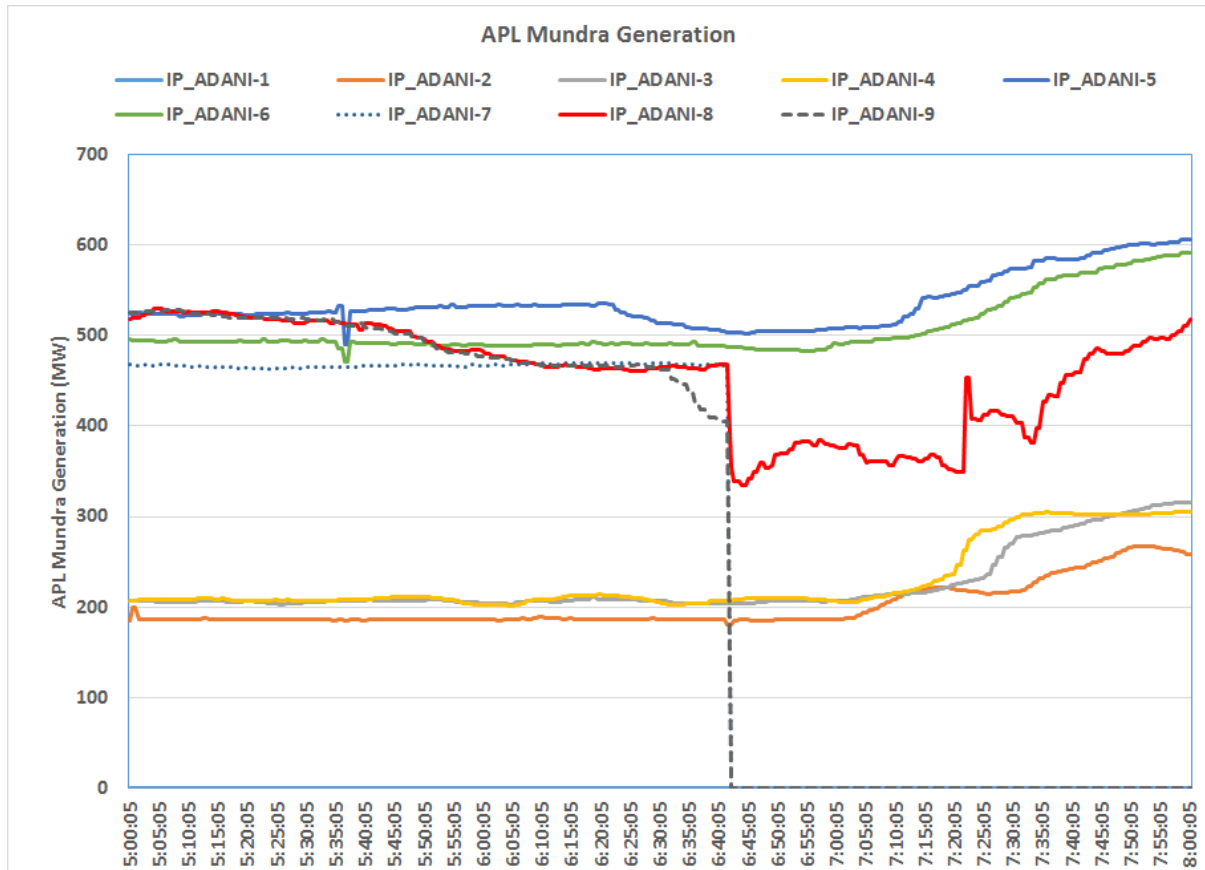
RESET ALARMS MAIN BCU

RESET ALARMS REDUNDANT BCU

SPS NR OPERATED MAIN BCU

SPS NR OPERATED REDUNDANT BCU

5. Generation Reduction plot at APL Mundra



Grid Incidence at Ranchropura Sub-station on 28th December 2015

Event Category: GI-2

Event Date and Time:

Event Summary: R phase CT of 400 kV CGPL make Bus coupler at 400/220 kV Ranchorpura sub-station burst which created bus fault on 400 kV Bus 1 and Bus 2 causing bus bar protection operation. This resulted in tripping of all 400 kV lines and 400/220 kV ICTs from Ranchoprura S/s. No Load/Generation loss occurred during the event as 220 kV remain intact during the event.

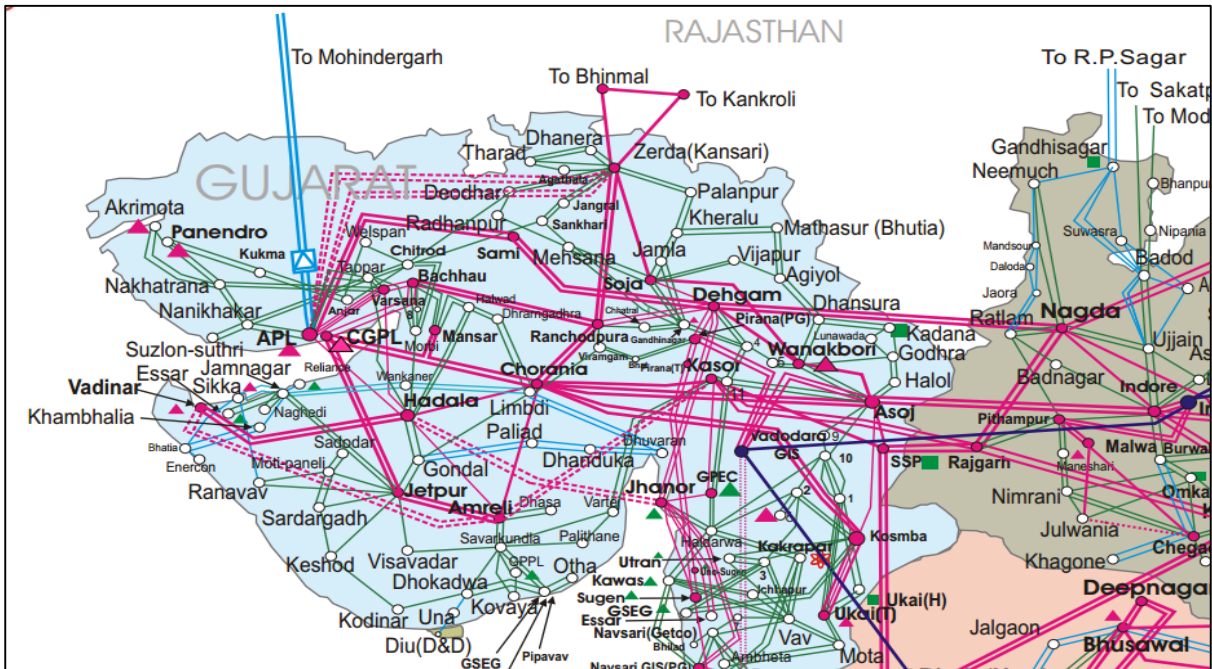


Figure 1 : Geographical Map

Antecedent Condition:

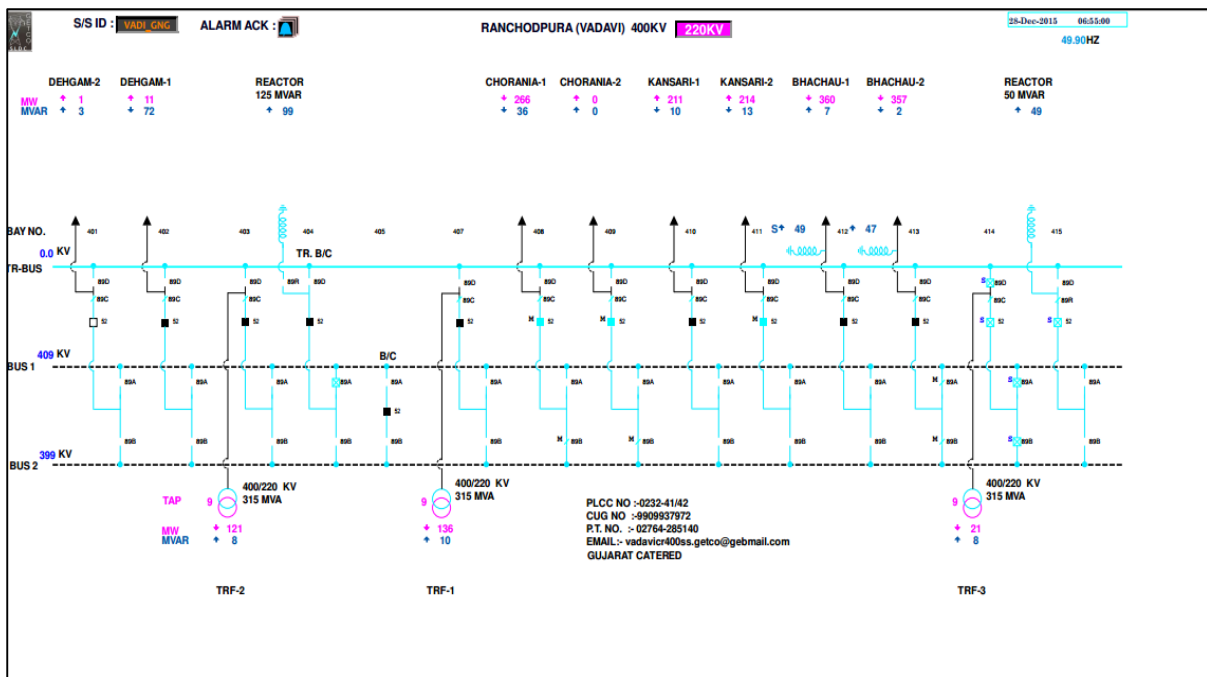


Figure 2 : 400 kV Ranchopura Bus at 06:55

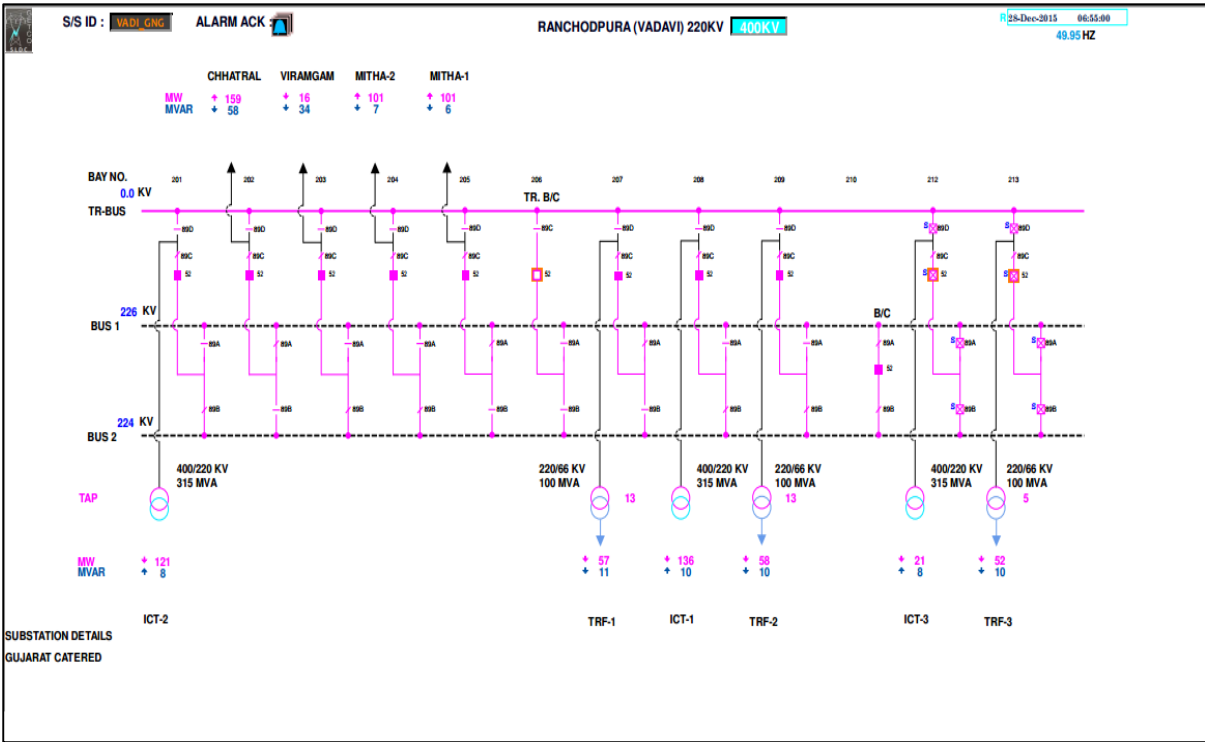


Figure 3 : 220 kV Ranchorpura Bus at 06:55

Event Overview: GETCO Report is attached for the details. 400 kV Ranchorpura Bus became dead during the event.

Post Event Condition:

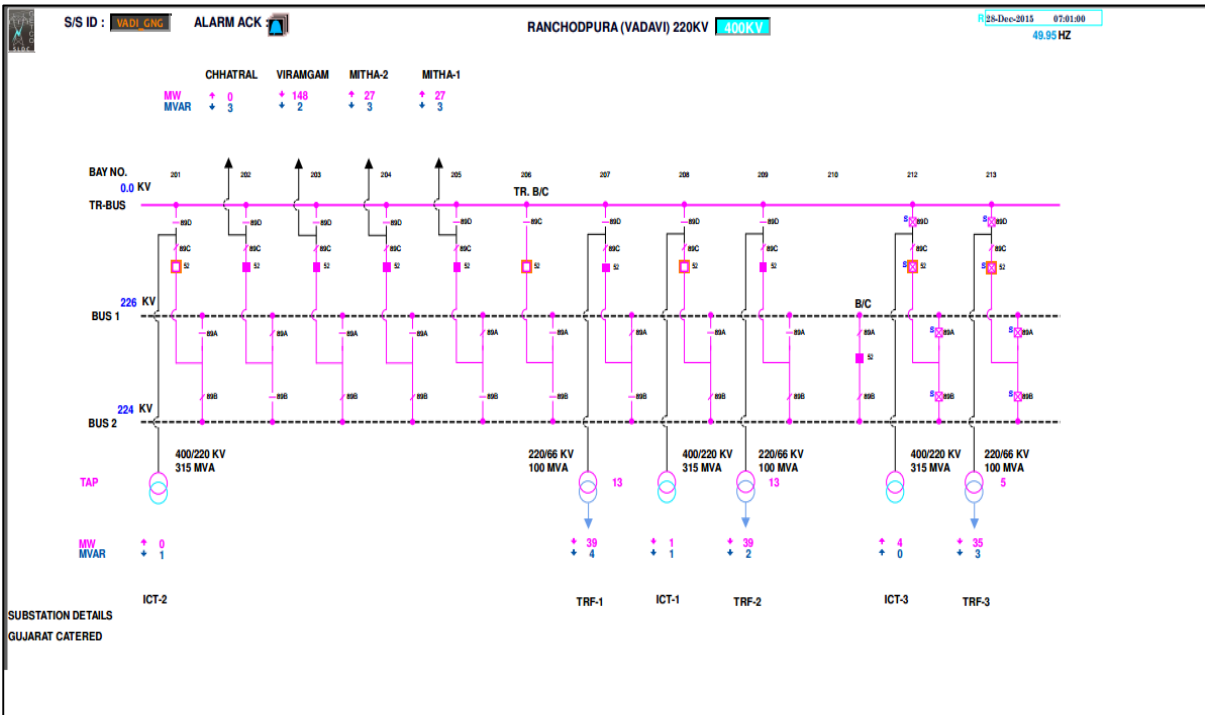


Figure 4 : 220 kV Ranchorpura Bus at 07:01

Sub: Bus bar operation at 400 KV Vadavi substation on dated 28/12/2015

- (1) Name of Sub Station : 400 KV S/S Vadavi
- (2) Date & time of occurrence: 28.12.15 at 6.57 Hrs
- (3) Bus position prior to occurrence: The Bus position of feeders prior to occurrence was as under. The bus coupler breaker was ON.

| 400 KV Bus A | 400 KV Bus B |
|------------------------------------|----------------------------------|
| 1) 400 kv Bhachau Line-2 (ON) | 1) 400 kv Bhachau Line-1 (ON) |
| 2) 400 kv Kansari Line-2 (ON) | 2) 400 kv Kansari Line-1 (ON) |
| 3) 400 kv 315MVA ICT-2 (ON) | 3) 400 kv 315MVA ICT-3 (ON) |
| 4) 400 kv Chorania line-2 (HV OFF) | 4) 400 kv Chorania line-1 (ON) |
| 5) 400 kv 125MVAR Bus reactor (ON) | 5) 400 kv 50MVA Bus reactor (ON) |
| 6) 400 kv 315MVA ICT-1 (ON) | 6) 400 kv 315MVA ICT-4 (ON) |
| 7) 400 kv Dehgam Line -2 (HV OFF) | 7) 400 kv Dehgam Line -1 (ON) |
| 8) 400 kv Halvad Line -2 (ON) | 8) 400 kv Halvad Line -1 (ON) |

(4) Prior to Occurrence:

- The 400 KV Vadavi-Chorania line no.2 and 400 KV Vadavi-Dehgam line no.2 were OFF due to system high voltage.

(5) Sequence of Occurrence:

- On dated 28.12.15 at 6.57 hrs. all the feeders connected to bus-A and bus B were tripped on 96 relay due to operation of bus zone-1 and bus zone-2 of bus bar protection scheme.
- All 400/220 KV, 315 MVA ICTs were tripped on inter trip from 220 KV (LV side).
- All 400 KV lines were tripped on direct trip at opposite ends.

(6) Cause of operation of bus bar protection scheme:

- 400 KV bus bar protection scheme was correctly operated due to failure of R-Ph C.T (CGL Make) of 400 KV bus coupler.
- The ABB makes static RADSS type bus bar protection scheme is in service at 400 KV Vadavi substation.

(7) **Relay Indications of lines/Tr./bus coupler**

| Sr. No | Name of feeder/Tr. | SS end | Opposite end |
|--------|-----------------------|--------|--------------|
| 1 | 400 KV Bhachau Line-2 | 96 | DT receive |
| 2 | 400 KV Kansari Line-2 | 96 | DT receive |
| 3 | 400 KV Halvad line-2 | 96 | DT receive |
| 4 | 400 KV Bhachau Line-1 | 96 | DT receive |
| 5 | 400 KV Kansari Line-1 | 96 | DT receive |
| 6 | 400 KV Chorania-1 | 96 | DT receive |
| 7 | 400 Kv Dehgam Line -1 | 96 | DT receive |

| | | | |
|----|------------------------------|--------------------------|------------|
| 8 | 400 KV Halvad line-1 | 96 | DT receive |
| 9 | 400 KV Bus coupler | 96 | -- |
| 10 | 400 KV 315 MVA ICT-1 | HV: 96 LV: inter trip | |
| 11 | 400 KV 315 MVA ICT-2 | HV: 96 LV: inter trip | |
| 12 | 400 KV 315 MVA ICT-3 | HV: 96 LV: inter trip | |
| 13 | 400 KV 315 MVA ICT-4 | HV: 96 LV: inter trip | |
| 14 | 400 KV, 125 MVAR Bus reactor | 96 | |
| 15 | 400 KV, 50 MVAR Bus reactor | 96 | |

(8) Analysis and Action taken:

- The ABB makes static RADSS type bus bar protection scheme is correctly operated at 400 KV Vadavi substation. No DR records found due to static schemes.
- M/s CGL representative has visited the site on 28.12.15. The photo graphs of failed C.T are enclosed herewith.
- The failed R-Phase C.T is replaced with the new R-Phase C.T on 29.12.15.

(9) Resumption

| Sr. No | Name of feeder/Tr. | From Hrs. | To Hrs. |
|--------|-----------------------------|-----------|---------|
| 1 | 400 KV Bhachau Line-2 | 6.57 | 7.35 |
| 2 | 400 KV Kansari Line-2 | 6.57 | 7.36 |
| 3 | 400 KV Halvad line-2 | 6.57 | OFF |
| 4 | 400 KV Bhachau Line-1 | 6.57 | 8.47 |
| 5 | 400 KV Kansari Line-1 | 6.57 | 8.42 |
| 6 | 400 KV Chorania-1 | 6.57 | 7.46 |
| 7 | 400 KV Dehgam Line -1 | 6.57 | 9.16 |
| 8 | 400 KV Halvad line-1 | 6.57 | OFF |
| 9 | 400 KV Bus coupler | 6.57 | OFF |
| 10 | 400 KV 315 MVA ICT-1 | 6.57 | 7.46 |
| 11 | 400 KV 315 MVA ICT-2 | 6.57 | 8.30 |
| 12 | 400 KV 315 MVA ICT-3 | 6.57 | 8.30 |
| 13 | 400 KV 315 MVA ICT-4 | 6.57 | 9.35 |
| 14 | 400 KV 125 MVAR Bus reactor | 6.57 | OFF |
| 15 | 400 KV 50 MVAR Bus reactor | 6.57 | |
| 16 | 400 KV Chorania-2 | HV OFF | 7.40 |
| 17 | 400 KV Dahegam-2 | HV OFF | 8.04 |

(10) Single Line diagram : Enclosed herewith.

(11) The detail of failed equipment.

- (a) Name of Equipment : R-Phase C.T of 400 KV Bus coupler bay
(b) Make & Type : CGL
(c) Sr. No. of equipment : 52976
(d) Yr. of Mfg : 2013
(e) Date of commissioning : 15/10/15.
(f) Guarantee period : WGP (failed within Guarantee period)
(g) Previous Tan delta results: As under.
(h) Other results : Attached herewith.
(i) Oil leakage : Not found (As per site visit report on 28.12.15)

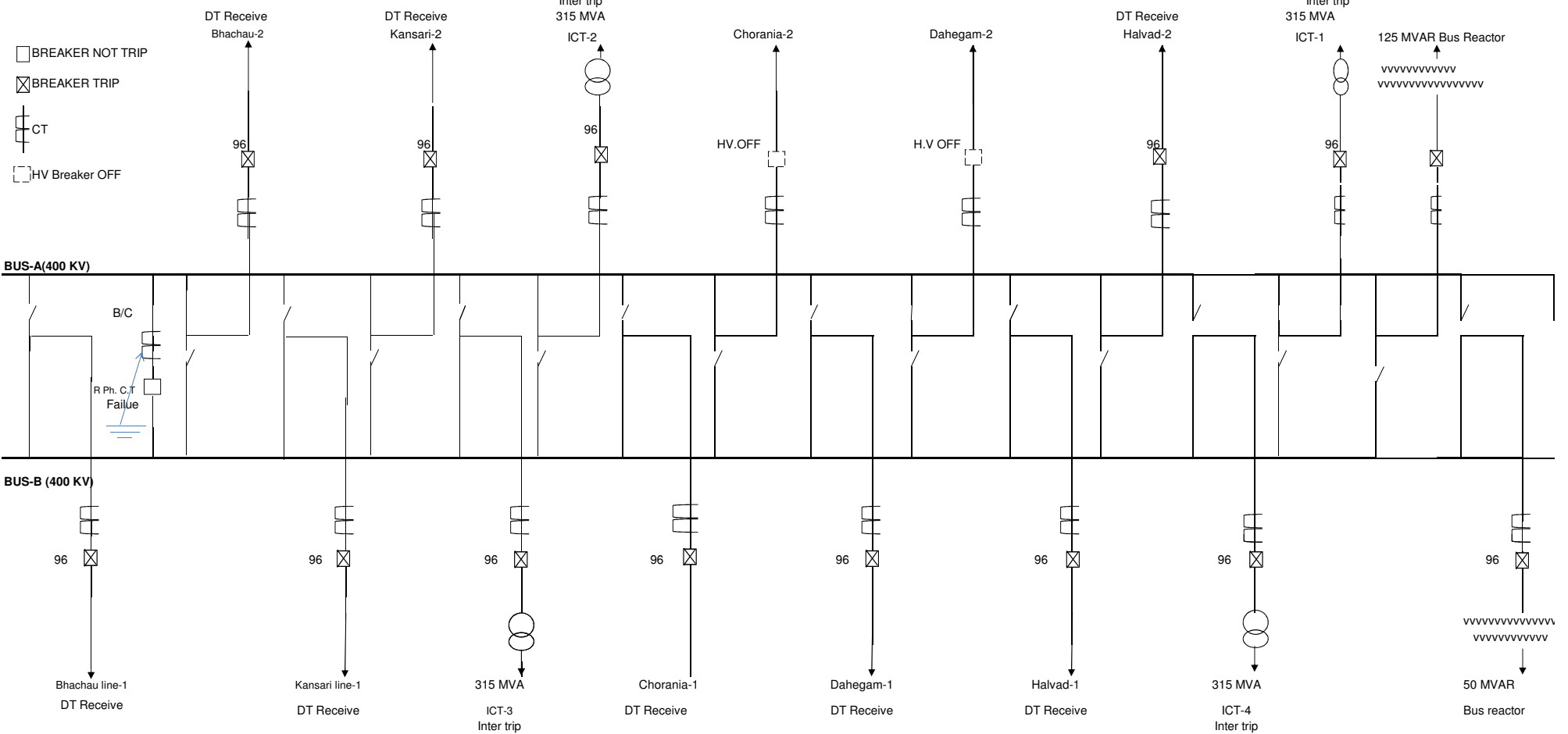
Tan Delta results

| Date | Capacitance (pf) | Tan Delta (%) | Remark |
|-----------------|------------------|---------------|---|
| 9/10/15 | 1141.3 | 0.150 | HV to Cy (with secondary windings and terminal box and base grounded) |
| Factory Results | 1123.6 | 0.181 | |

Conclusion:

- The tan delta and capacitance results were within acceptable limits at the time of commissioning.
- The matter is referred to M/s CGL for analysis of failure and free replacement as it failed within guarantee period.

OCCURRENCE AT 400 KV VADAVI SUBSTATION



Grid Incidence in South Gujarat due to fog on 26th February 2016

Event Category: GI-2

Event Date and Time: 02:00 -07:00 Hrs, 26th February 2016

Event Summary: Due to dense fog in the south Gujarat, several lines have tripped on insulator flashover and arcing faults. However there was no interruption in any of the area with these tripping.

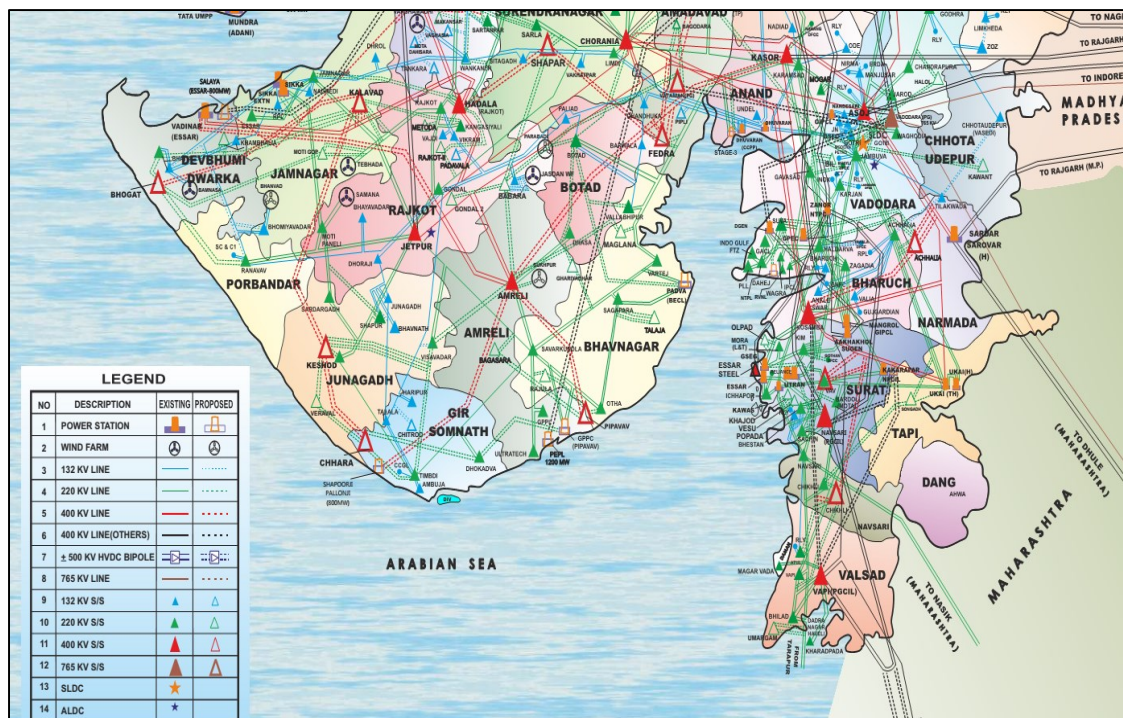


Figure 1 : Geographical Map (Source: GETCO)

Event Overview: In the morning hour of 26th February 2016, dense fog was observed in the South Gujarat area. One by one each line tripping has been discussed based on preliminary report submitted by SLDC Gujarat.

- 220 kV Kosamba-Utran circuit 1:** This circuit tripped at 02:21 Hrs and remain out due to permanent nature of fault.
 - Kosamba end: Z-1, B Phase to E/F, 14 Km, Fault current=8.30 kA
 - Utran end: Z-2, B Phase to E/F, 45.4 Km, Fault current=6.457 kA.

Test charge was taken at 03:27 hours from Kosamba end, but line tripped again on Z-1 on Y Phase to E/F at a distance of 15.9 km, Fault current IR=8.04 kA, IY=7.48 kA, IB=10.33 kA. At Location number 90(S), B phase insulator string was found flashed over and same was replaced. At 18:33 Hrs, line trial charge was again taken from Kosamba end, but it tripped on Z1, Y phase to E/F at a distance of 15.8 km with fault current IY=9.36 kA along with SOTF operation. At loc. No. 80 (S), Y phase insulator string was found in flashed over condition and same was replaced. Finally the line was charged at 08:43 Hrs.

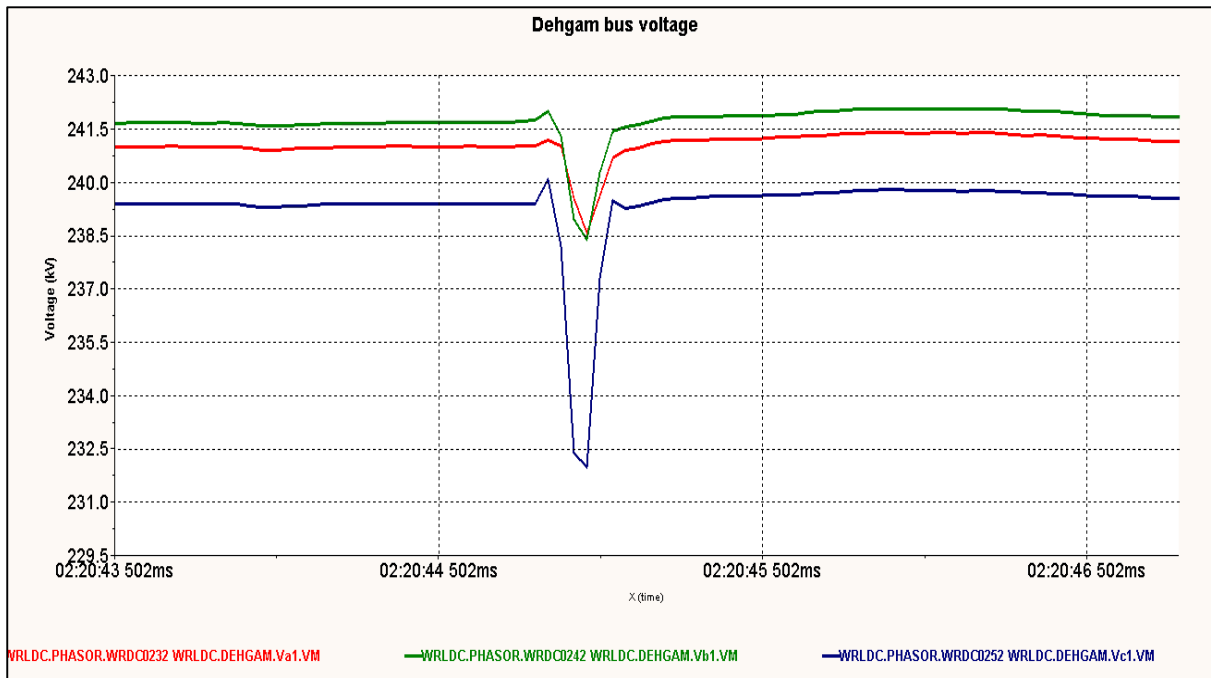


Figure 2: B phase to E/F on 220 kV Kosamba-Utran circuit at 02:21 Hrs. No A/R is observed on the circuit and it has tripped.

2. 220 kV Kosamba-Vav circuit: R phase to E/F occurred on circuit at 02:24 Hrs and it got successfully reclosed. Further at 02:28 Hrs, Y phase to E/f occurred on the circuit and its A/R was successful. At 02:41 Hrs, Initially Y phase fault appeared which was at 14.5 kA with fault current of 8.17 kA. The circuit got successfully reclosed. After this within next 7 second fault reappeared in R Phase at 18.25 km from Kosamaba with fault current 7.96 kA. With this the circuit tripped as circuit breaker was under reclaim period.

After patrolling it was found that at Location No. 90(S) R phase string and at Location No. 124 (S) Y phase string were found in flashed over condition. These were replaced and circuit was taken in service at 14:51 Hrs.

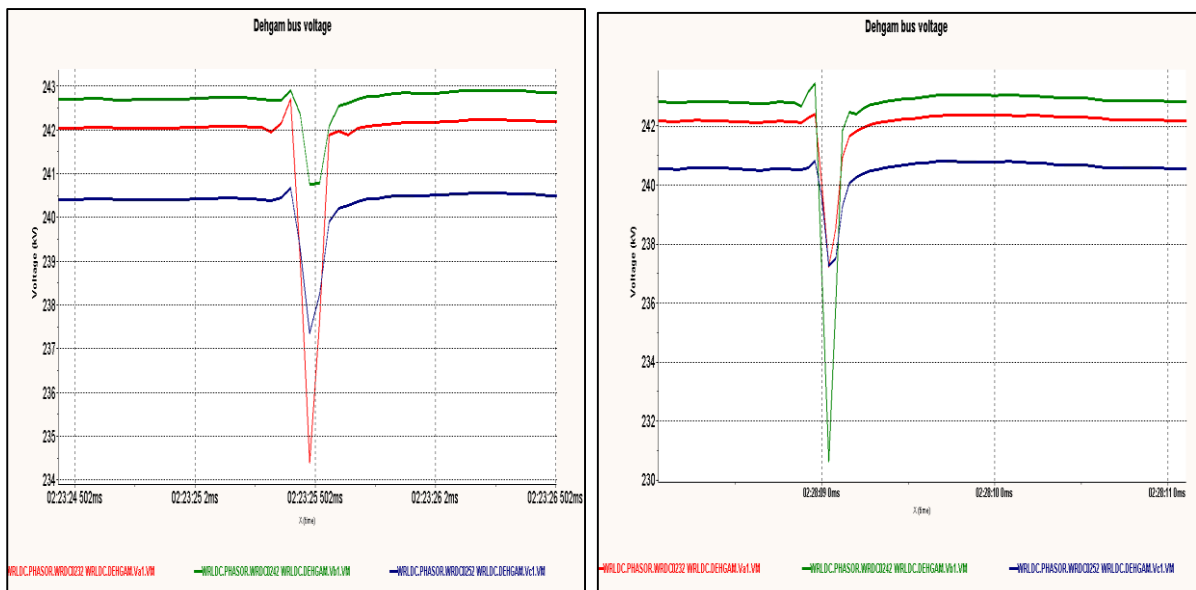


Figure 3: R phase to E/F at 02:24 and Y phase to E/F on 02:28 Hrs on 220 kV Kosamba-Vav circuit. A/R successfully operated on both occasions.

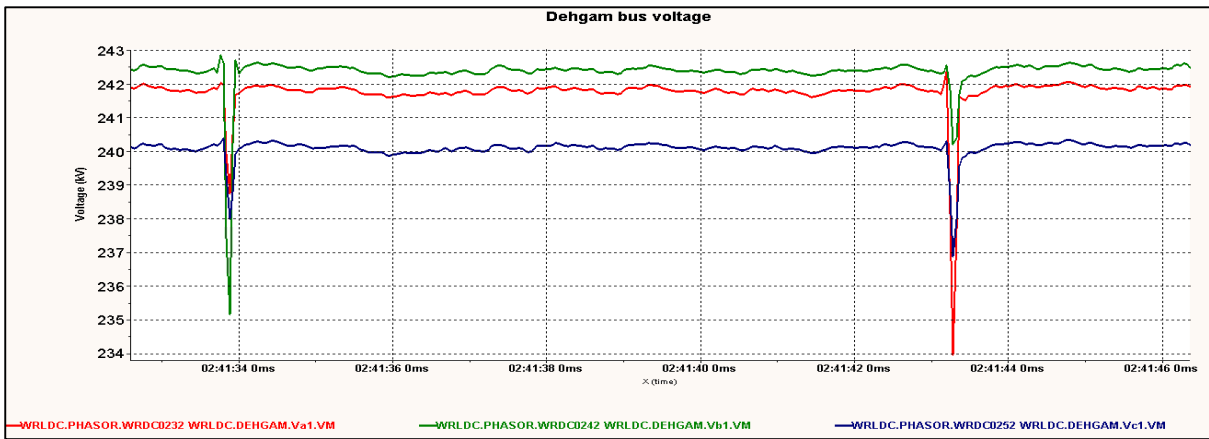


Figure 4: Y phase to E/F on 220 kV Kosamba-Vav circuit at 02:41 Hrs. A/R successfully operated. Fault reappeared in dead time in R phase and circuit tripped.

3. 220 kV Kosamba-Kim circuit 2: This circuit tripped on R phase to E/F with relay indication as given below.

- Kosamba end: Zone1, R Phase to E/F, 9.7 km, IR=15.45 kA
- Kim end: Zone 1 , R Phase to E/F, 35.2 km, 5.17 kA

Based on the PMU plot it was observed that auto-reclosure has not operated on the circuit from one end or either end. The circuit was taken in service at 08:48 Hrs after patrolling.

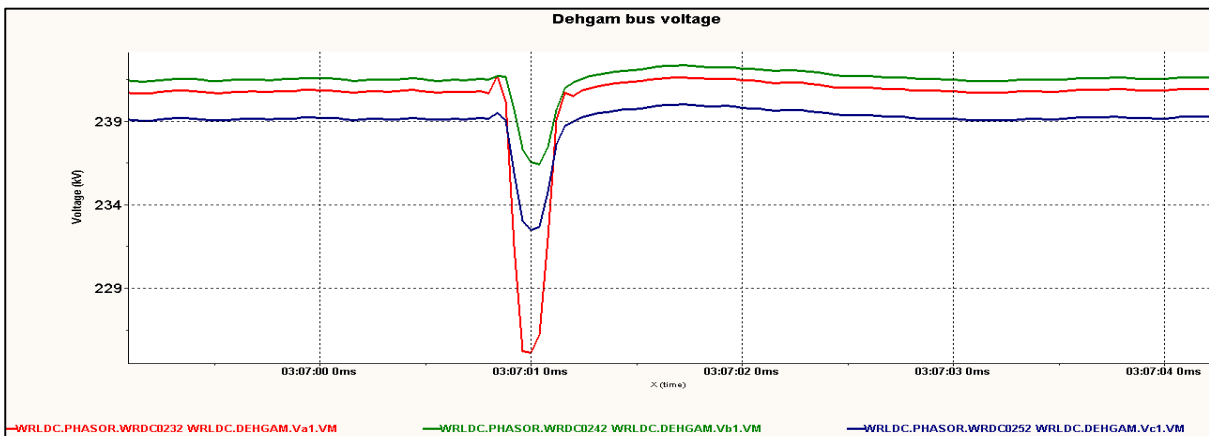


Figure 5: R phase to E/F on 220 kV Kosamba-Kim circuit at 03:07Hrs. No A/R operation is observed on the circuit.

4. 220 kV Sugan-Kim circuit 1: Y phase to E/f occurred on this circuit. No Details were received from the utility. This line was taken in service at 04:20 Hrs.

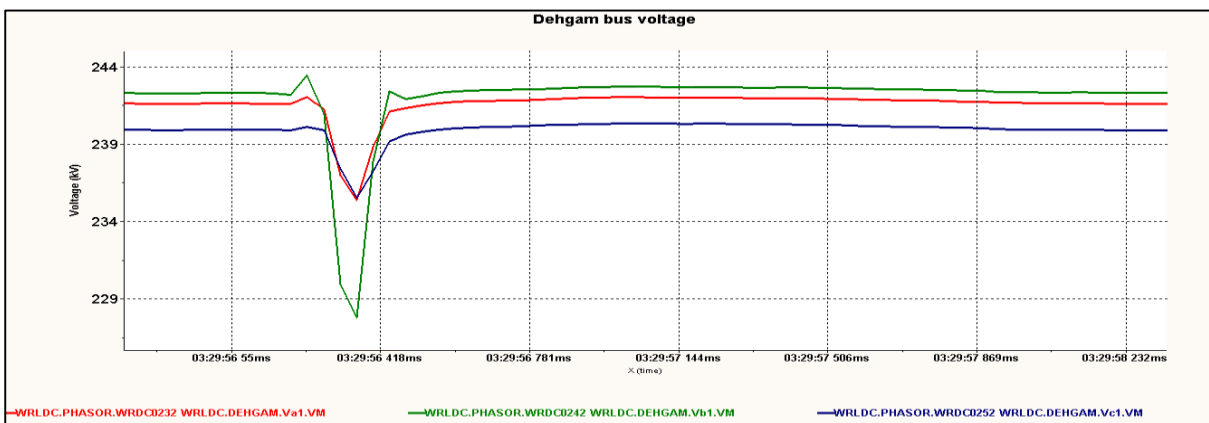


Figure 6: Y phase to E/F on 220 kV Sugan-Kim circuit 1 at 03:29rs.

- 220 kV Kawas-Dastan:** R phase to E/F occurred on 220 kV Kawas-Dastan circuit. The fault was of permanent nature and lines was charged after completion of rectification work. No Details were received from NTPC and GETCO.

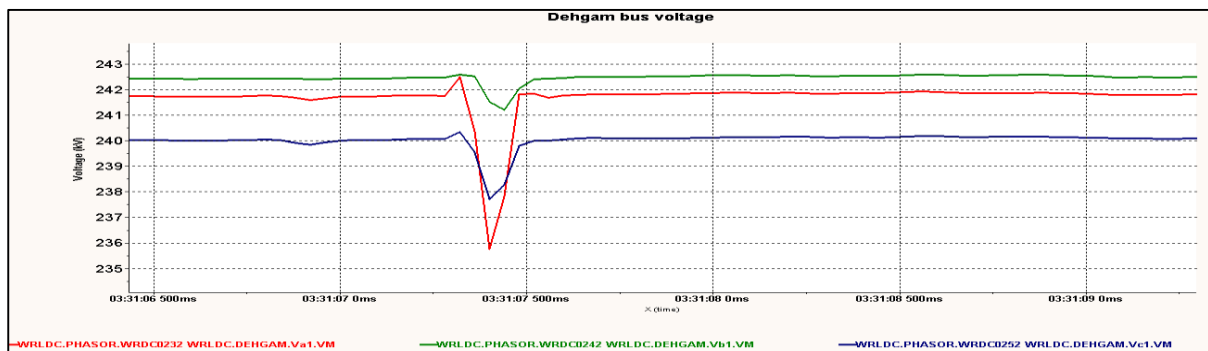


Figure 7: R phase to E/F on 220 kV Kawas-Dastan circuit at 03:31 Hrs.

- 400 kV Sugan-Zhanor circuit:** This circuit experienced Y phase to earth fault and successful A/R operated. DR for the same is attached as annexure. Fault current at Sugan end is 6.06 kA.

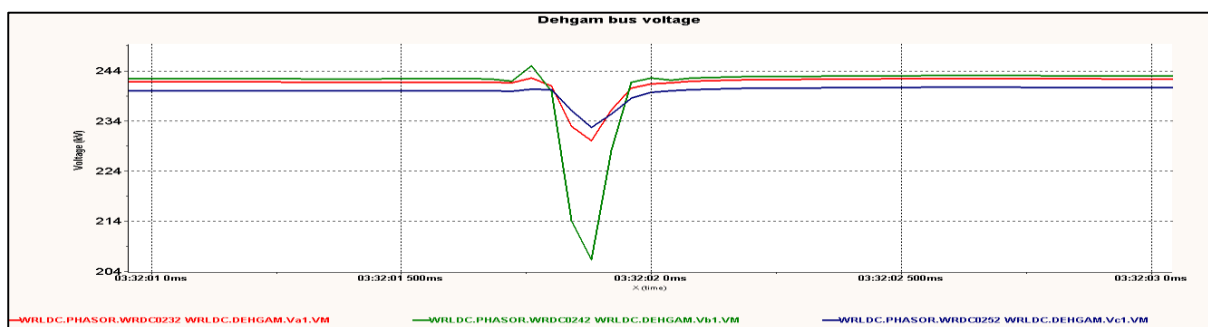


Figure 8: Y phase to E/F on 400 kV Sugan-Jhanor circuit at 03:32 Hrs. Line got successfully reclosed.

- 220 kV Sugan-Kim circuit 2:** R phase to E/F occurred on the circuit at 03:34 Hrs. Circuit was taken back in service at 04:20 Hrs.

220 kV Kosamba-Kim 1: R phase to Earth fault occurred on the circuit at 03:34 Hrs due to insulator string flashover. This was replaced and circuit was taken back in service at 11:38 Hrs.

- Kosamba end: Zone1, R phase to E/F, Fault location: 2.3 Km, Fault current : 16.48 kA
- Kim end: Zone1, R phase to E/F, Fault location: 19.3 Km, Fault current : 6.06 kA

PMU plot shows two voltage dip however without DR/EI from GETCO/Sugan it could not ascertained which plot belongs to which line tripping. In one line A/R has operated while in other it has not operated.

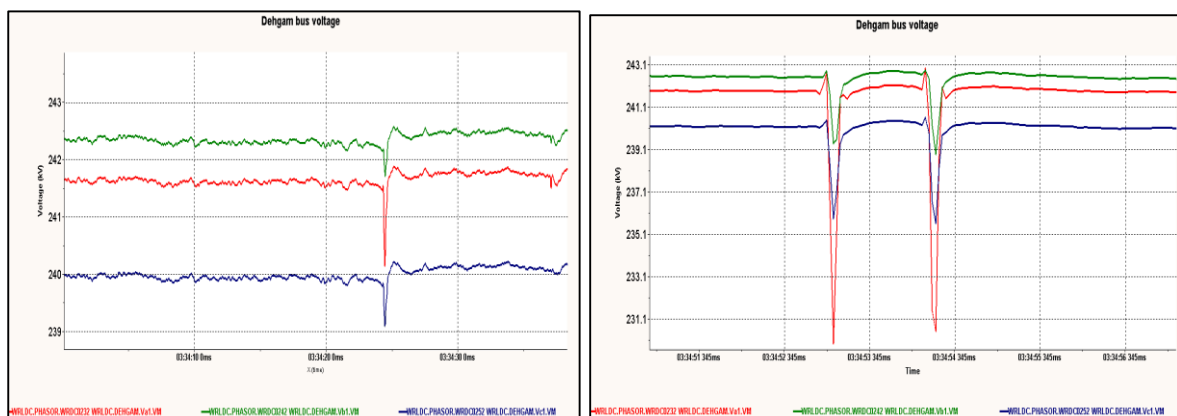


Figure 9: PMU plots for R phase to E/F on 220 kV Sugan Kim 2 and Kosamba-Kim 1. The plot could be correlated to tripping as DR/EL is not available from Sugan/GETCO.

8. **400 kV Kosamba-Asoj circuit:** R phase to E/F occurred on the circuit and after one second it got successfully reclosed.

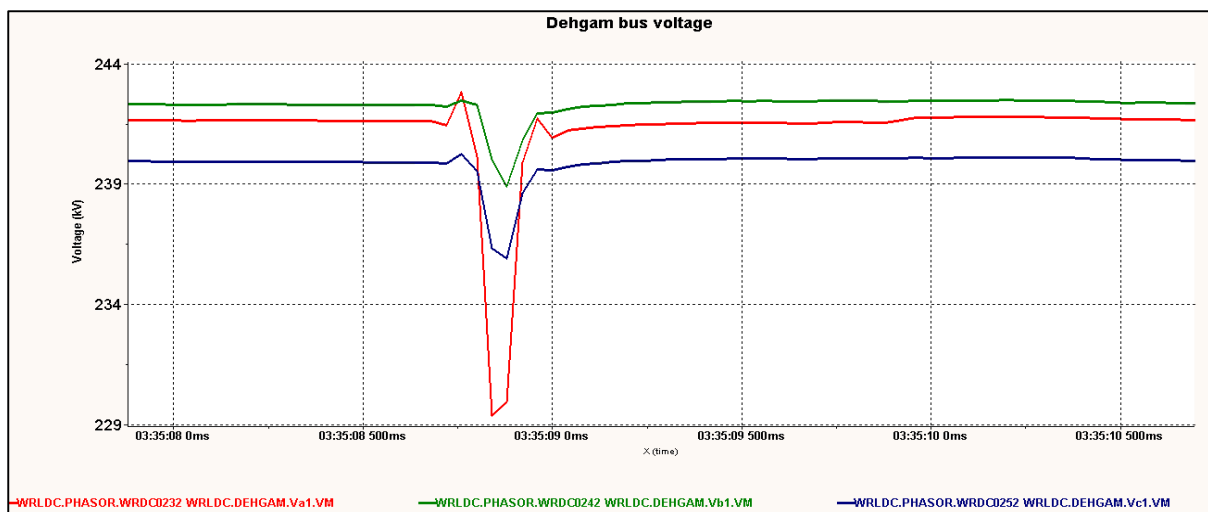


Figure 10: R phase to E/F on 400 kV Kosamba-Asoj circuit at 03:35 Hrs. A/R was attempted successful and circuit remain in service.

9. **220 kV Kosamaba-GSEG 1:** At 04:19 Hrs, B phase to Earth fault occurred on 220 kV Kosamba-GSEG 1 circuit. A/R was not observed. At location No. 4 (T) Y Phase Jumper found open which was attended. Line was taken at 16:32 Hrs due to issue with GSEG end breaker.

- Kosamba end: Zone 1, B Phase to E/F, Fault Location : 46.2 km, Fault Current : 3.41 kA
- GSEG end: Zone 1, B Phase to E/F, Fault Location : 3.4 Km, Fault Current :1.09 kA

At the same time 220 kV GSEG-KIM 1 also tripped on Zone 3 from Kim end on Zone 3 in B phase with fault location 51.9 and fault current 3.162 kA.

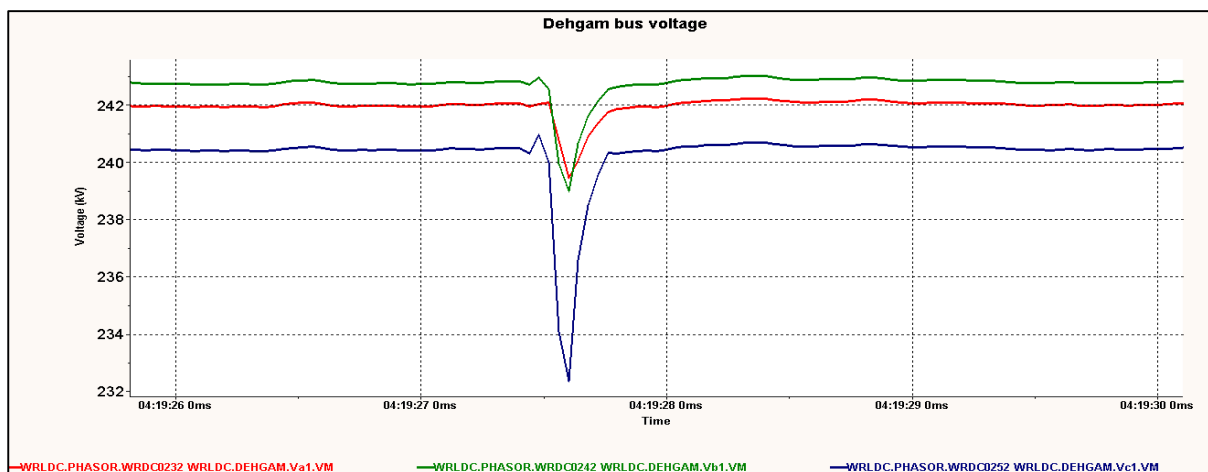


Figure 11: B phase to E/F on 220 kV kV Kosamba-GSEG 1 circuit at 04:19 Hrs. A/R was no observed.

10. **400 kV Kosamba-Asoj and 400 kV Kosamba-Choronia:** Y phase to Earth fault occurred on 400 kV Kosamaba-Asoj circuit and A/R was not successful with which line tripped. Circuit was taken in service 04:54 Hrs.

400 kV Kosamaba-Choronia circuit also tripped with following indication:

- Kosamba end: Carrier channel 1 & 2 code 2 received, 86A/86B operated
- Choronia end: Direct Trip received ,86A/86B operated.

This line restored at 15:42 Hrs due to rely reset problem in Kosamba S/S.

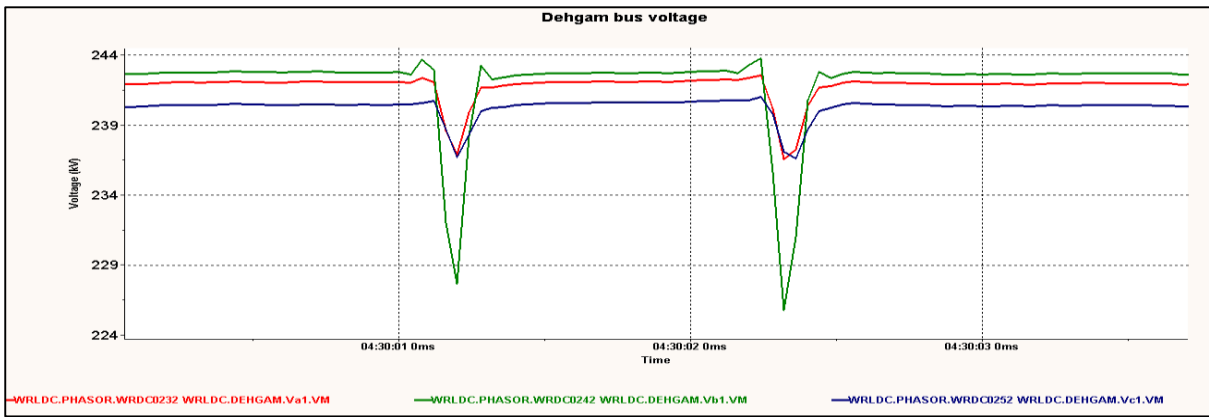


Figure 12: Y phase to E/F on 400 kV Kosamba-Asoj circuit at 04:30 Hrs. A/R is observed.

11. 220 kV SLPP Bus 2, 220 kV SLPP-Jhagadia circuit and 220/6.9 KV 15/25 MVA ST-2 SLPP: B phase to earth fault occurred during the tripping of these elements. No further details received from the utilities and SLDC.

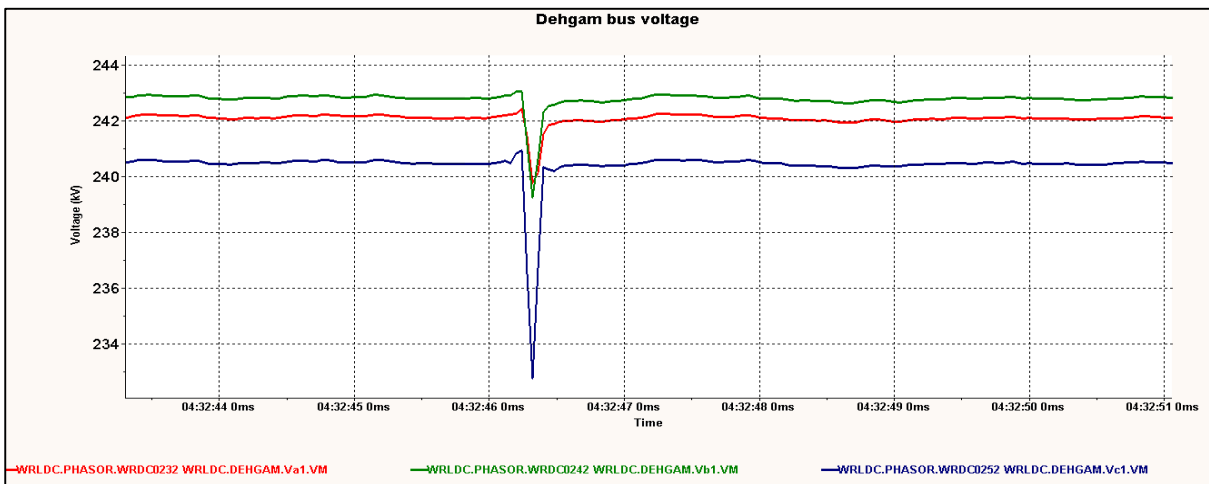


Figure 13: B phase to E/F on in the Gujarat grid when 220 kV Bus 2 of SLPP along with SLPP-Jhagadia 1 and ST tripped at 14:33 hrs.

12. 220 kV SLPP-Gavasad 1: This circuit tripped on R phase to earth fault at 04:50 Hrs. It was taken back in service at 13:40 Hrs.

- SLPP end: Zone 1, R phase to Earth Fault , Fault Current: 4.012 kA, Fault location : 28.05 km
- Gavasad end: Zone 1, R phase to Earth Fault , Fault Current : 2.031 kA, Fault location : 68.82 km

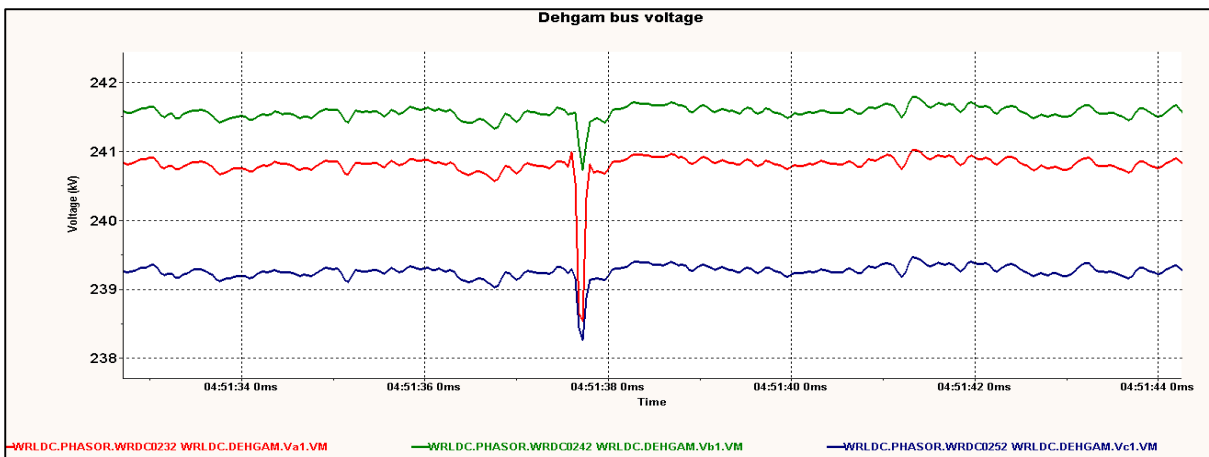


Figure 14: R phase to E/F on 220 kV SLPP-Gavasad 1 circuit at 04:50 Hrs. No A/R is observed.

13. 220 kV Kosamba-Suva: This circuit tripped on R phase to E/F and no A/R was observed. No further details obtained from SLDC and utility.

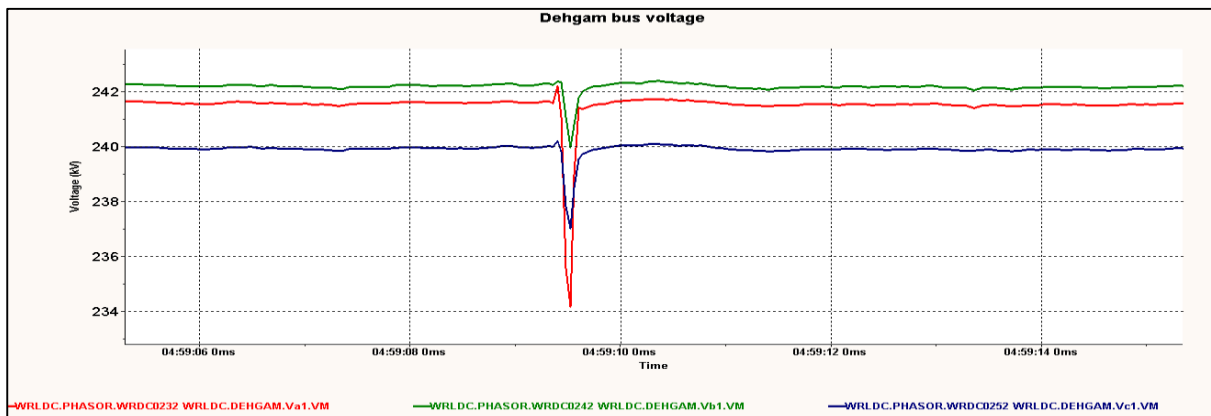


Figure 15: R phase to E/F on 220 kV Kosamaba-Suva circuit at 04:59Hrs. No A/R is observed.

14. 220 kV Kosamba-Gavasad 1: R phase to earth fault occurred on this circuit at 05:21 Hrs. No A/R is observed. Line was taken in service at 05:45 Hrs.

- Kosamba end: Zone 1, R phase to E/F, Fault Current : 8.66 kA, Fault location : 4.90 km
- Gavasad end: Zone 2, R phase to E/F, Fault Current : 1.9 KA, Fault location : 75.22 km

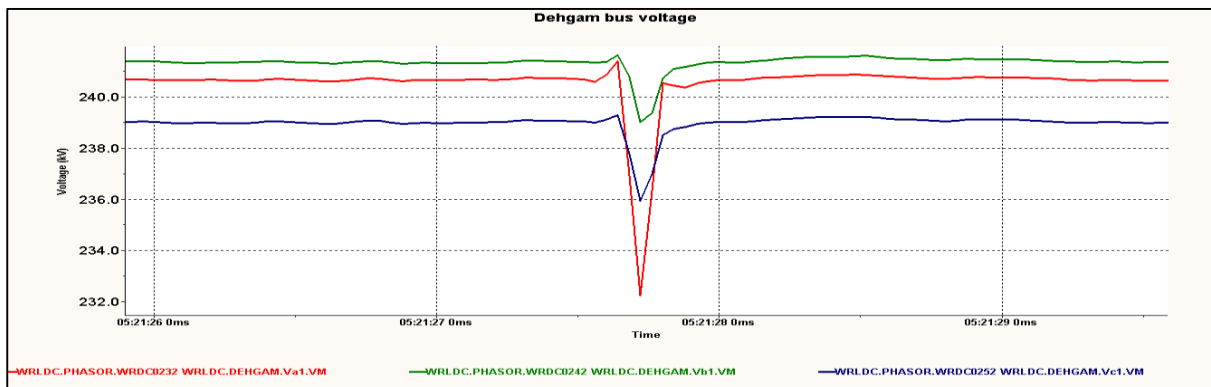


Figure 16: R phase to E/F on 220 kV Kosamaba-Gavasad 1 circuit at 05:21 Hrs. No A/R is observed.

15. 400 kV Kosamba-Ukai (T) 2: R phase to E/F occurred on the circuit at 06:03 Hrs. No A/R was observed.

- Kosamba end: Zone 1, R Phase to E/F, Fault location : 1.2 km, Fault current: 9.32 kA
- Ukai end: Zone 1, R Phase to E/F

After thorough patrolling, line was charged at 16:39 Hrs.

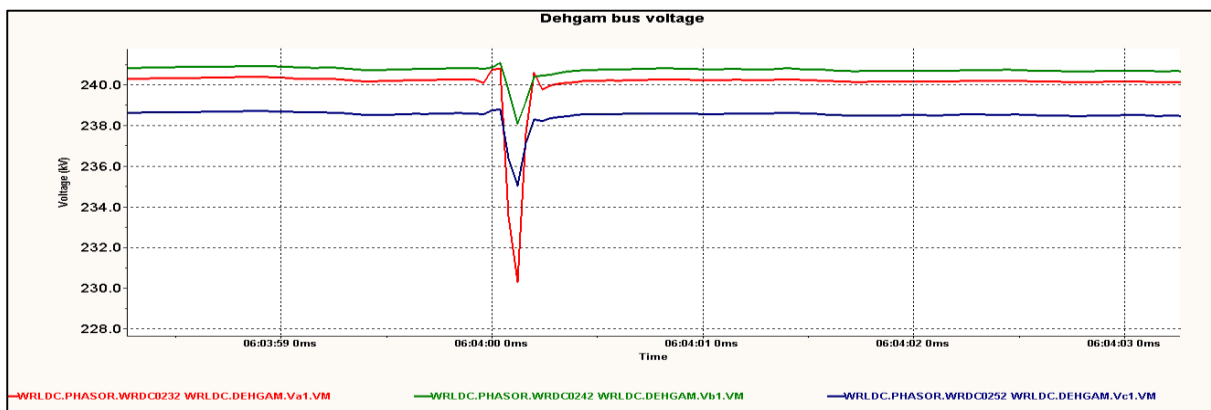


Figure 17: R phase to E/F on 400 kV Kosamaba-Ukai(T) circuit at 06:03 Hrs. No A/R is observed.

16. 220 kV Kosamba-Gavasad 1: R phase to earth fault occurred on this circuit at 06:26 Hrs. No A/R is observed. Line was taken in service at 06:54 Hrs.

- Kosamba end: Zone 1, R phase to E/F, Fault Current : 12.41 kA, Fault location : 5.7 km
- Gavasad end: Zone 1, R phase to E/F, Fault Current : 2.18 KA, Fault location : 62.77 km

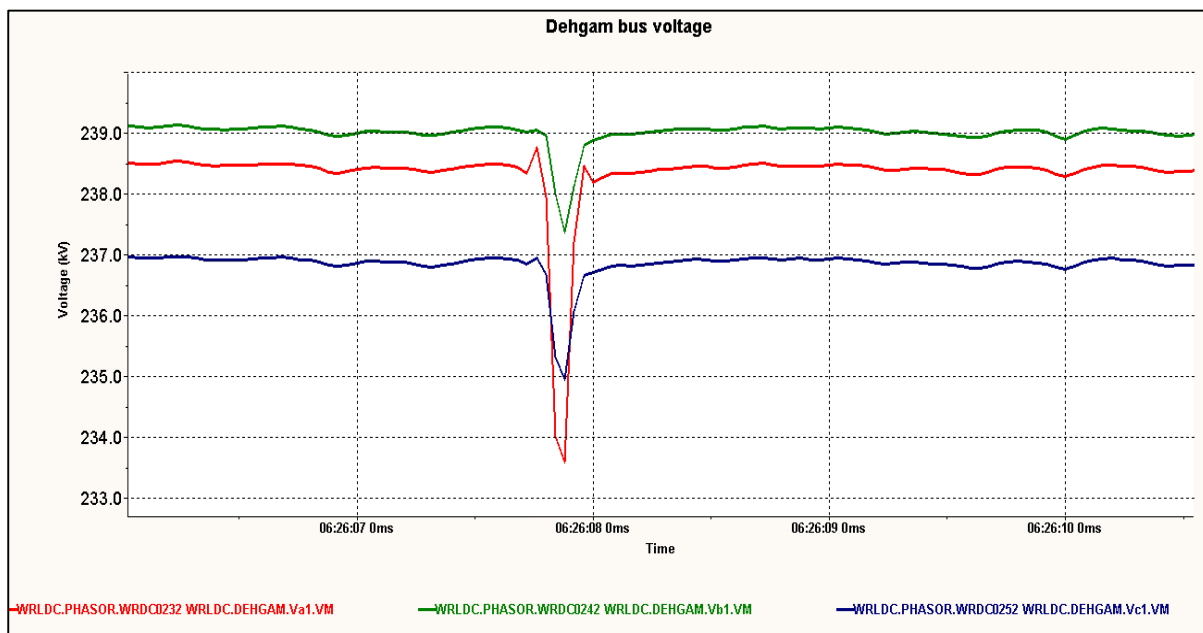


Figure 18: R phase to E/F on 220 kV Kosamaba-Gavasad 1 circuit at 06:26 Hrs. No A/R is observed.

17. 132 kV Bharuch-Ankleshwar 2: B phase to earth fault occurred at 07:11 Hrs. Line was taken in service at 11:39 Hrs.

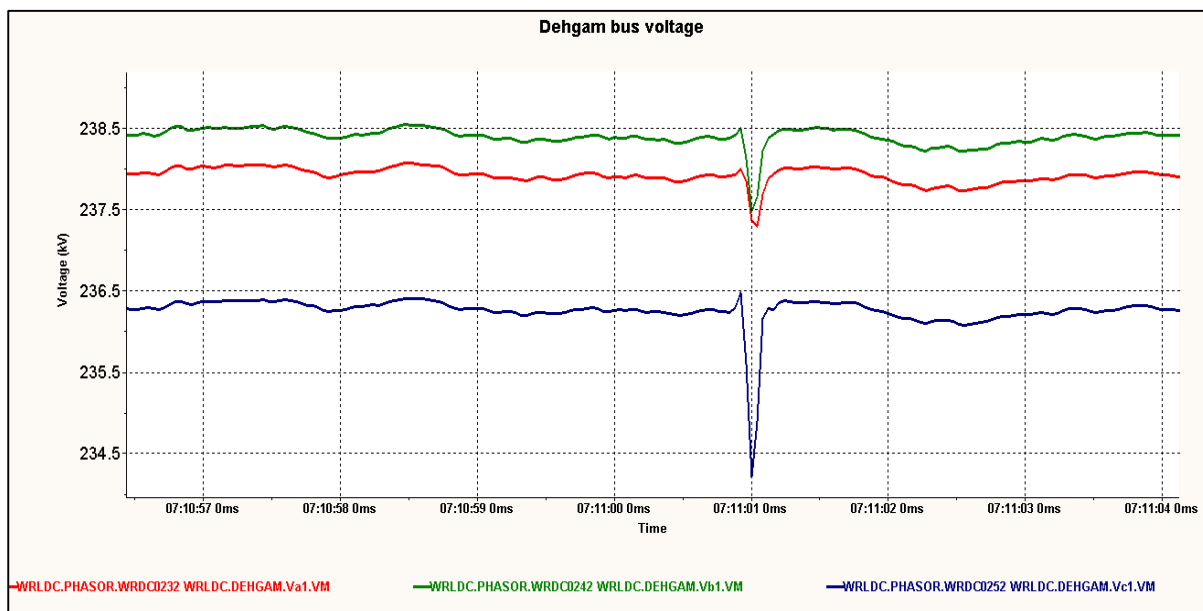


Figure 19: B phase to E/F on 132 kV Bharuch-Ankleshwar 2 circuit at 07:11 Hrs.

18. 220 kV Kakrapara-Haldarwa 2: Y phase to E/F occurred on the circuit at 07:29 Hrs. No A/R is observed. At location No. 209 (DS), Y phase insulator string found flashed over. Same was replaced by PGCIL and line was taken back at 20:45 Hrs.

- Haldarwa end: Zone 1, Y phase to E/F, Fault location: 4.4 km, Fault current : 18.75 kA
- KAPP end: Zone 1, Y phase to E/F

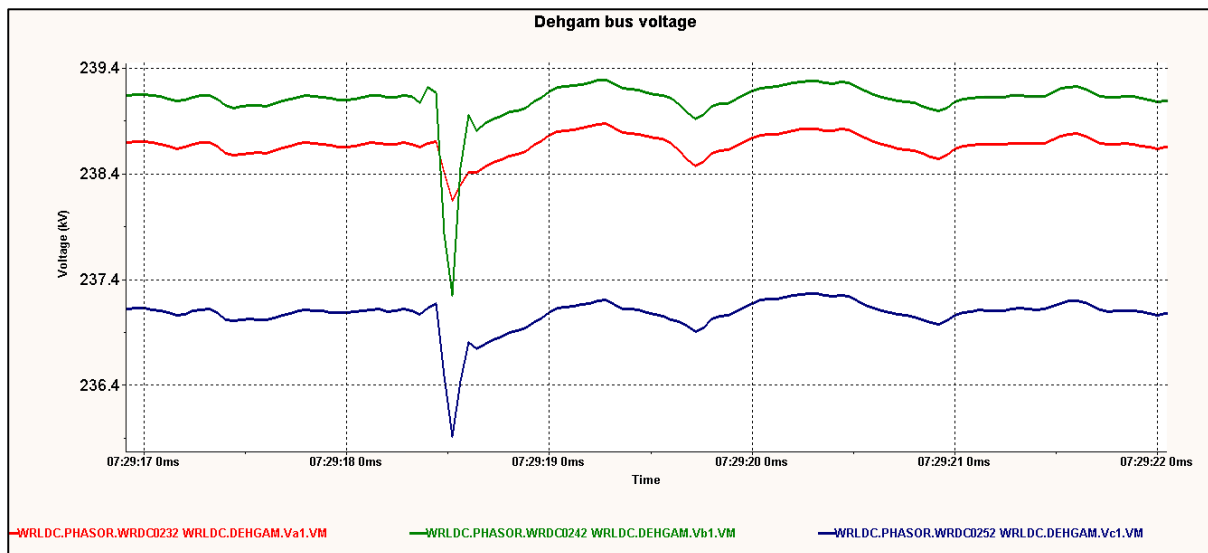


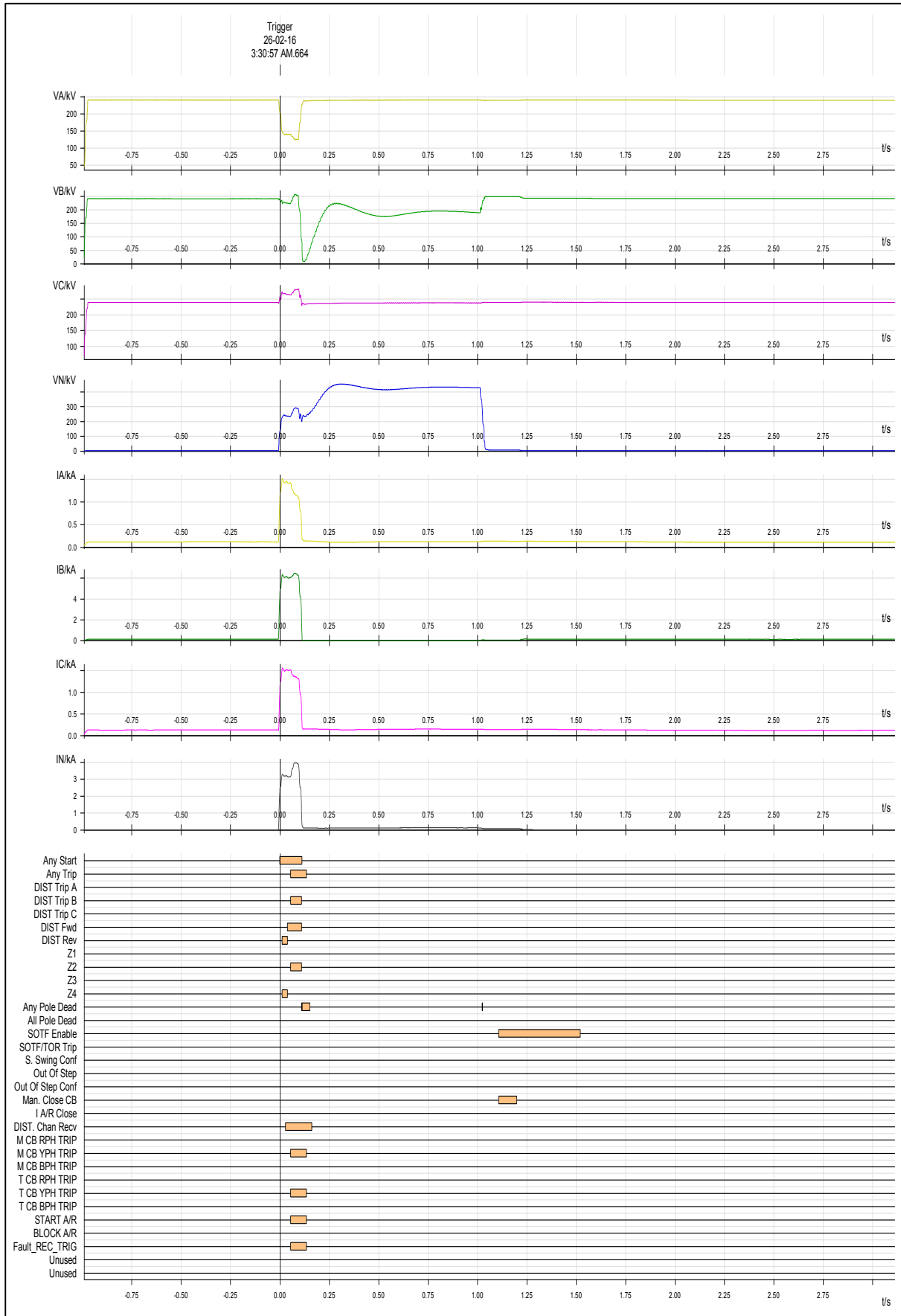
Figure 20: Y phase to E/F on 220 kV KAPS-Haldarwa 2 circuit at 07:29 Hrs.

Remarks:

- First of all, the data received from Gujarat SLDC/GETCO/Sugen/NPCIL/Generating station in Gujarat SLDC control area were insufficient for analysis of the event. No report was received from Gujarat SLDC where such multiple tripping has occurred even after several communication which was not desirable. Non-Compliance of IEGC, CEA grid standard, CEA Connectivity standard on the submission of DR/EL/Report has been observed by the above utilities which is undesirable.
- Based on the tripping analysis it is observed that several cases of insulator flashover were observed. Further in many case auto-reclosure are not observed on the 220 and 400 kV transmission lines.
- GETCO and other utilities which are involved in the above tripping may kindly ensure the A/R operation and healthiness on their transmission lines.
- Further, Anti-Fog Disc Insulators may kindly be used for such lines where heavy fog like this are expected especially in the southern Gujarat system. Such tripping has occurred in the past also and in view of reliable consumer supply, such multiple outage are not desirable.
- GETCO/Gujarat SLDC may kindly submit the details of actions taken after the fog related tripping under their area to WRLDC/WRPC.

Annexure:

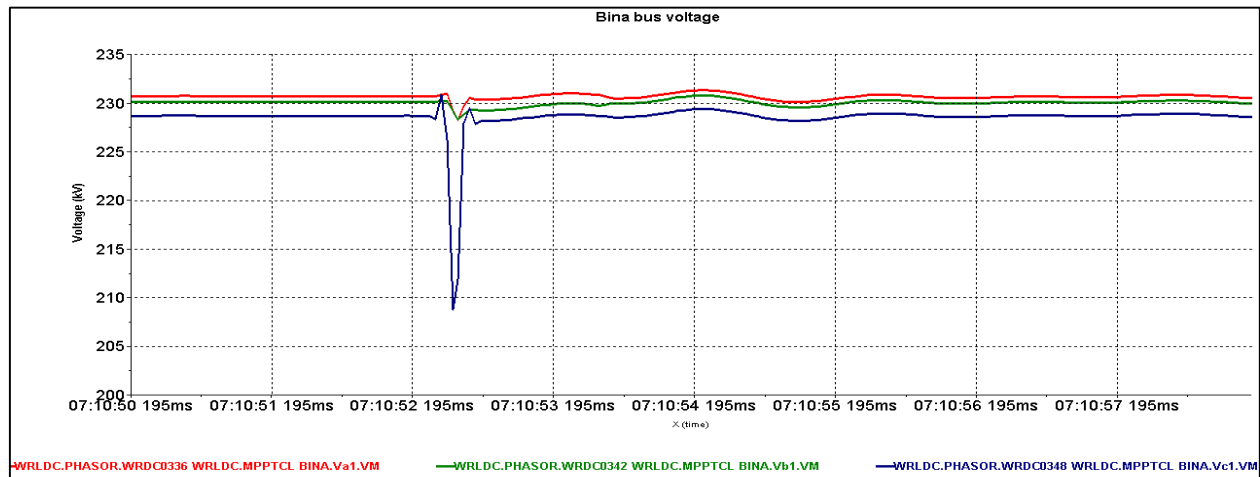
1. DR of 400 kV Sugan Jhanor circuit from Sugan end indicating successful A/R on the circuit.



Report on SPS operation for Gwalior-Agra on 14 Jan 2016

Due to foggy morning weather in the Northern region, 765 kV Gwalior –Agra D/C tripped on 14 Jan '16 on two occasions causing SPS operation. The event is analyzed in detail with PMU, SOE and event from sub-station.

1. The Event has started at 07:10 hrs onwards. First B phase to Earth fault occurred on 765 kV Gwalior-Agra circuit 1 at 07:10:52 Hrs and the circuit successfully reclosed after 1 second. The same can be seen from Bina Bus voltage captured from PMU and Gwalior SOE. SOE reflect that Main CB reclosed after 1 second while tie after 2 second.

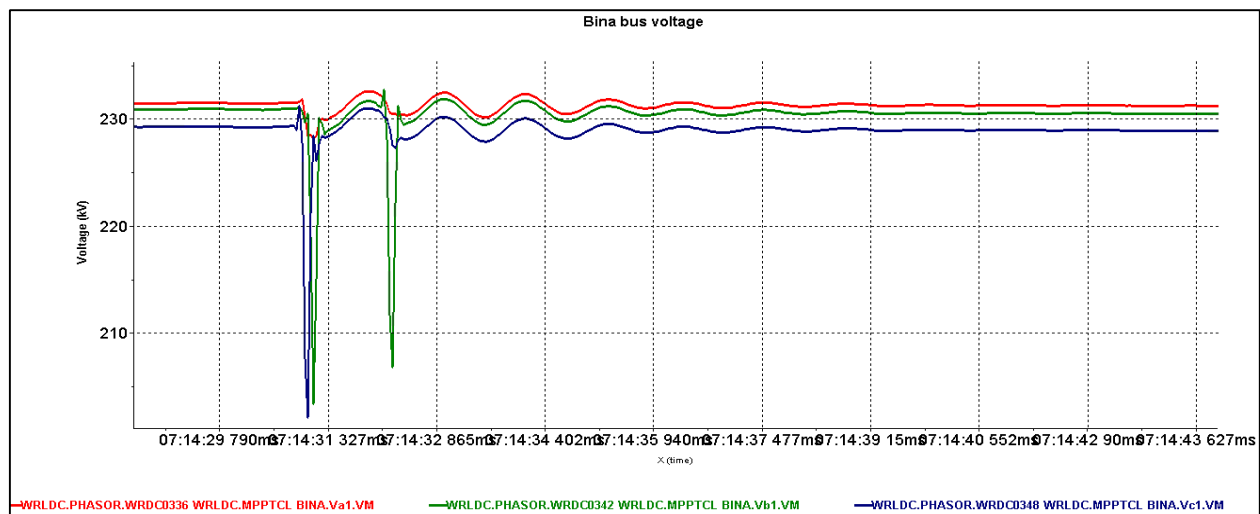


Gwalior SOE

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GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:10:52 ! 524
GWR765 AGRA1ICT2TIESOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:10:52 ! 525
GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Normal ! 14-01-2016 07:10:53 ! 575
GWR765 AGRA1ICT2TIESOE ! RSCC GWALIOR S 400 C ! Normal ! 14-01-2016 07:10:54 ! 599
```

Figure 1: Event at 07:10 Hrs on 765 kV Gwalior-Agra circuit 1

2. At 07:14: 31 Hrs B phase to E/F occurred on 765 kV Gwalior-Agra circuit 1 and Y Phase to E/F on circuit 1. After one second of A/R period, Circuit 1 successfully reclosed while Y phase fault persisted on circuit 2 causing its tripping .The same can be seen from Bina Bus voltage captured from PMU and Gwalior SOE. SOE reflect that Main CB reclosed after 1 second while tie after 2 second.



Gwalior SOE

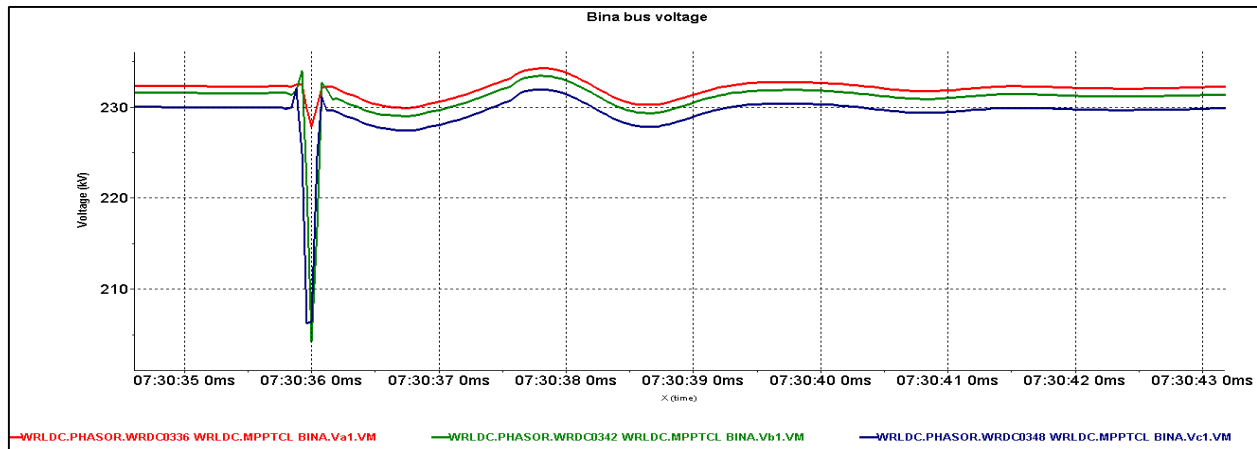
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GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:14:31 ! 61
GWR765 AGRA1ICT2TIESOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:14:31 ! 89
GWR765 AGRA2 BINAITIESOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:14:31 ! 163
GWR765 AGRA 2 SOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:14:31 ! 162
GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Normal ! 14-01-2016 07:14:32 ! 116
GWR765 AGRA1ICT2TIESOE ! RSCC GWALIOR S 400 C ! Normal ! 14-01-2016 07:14:33 ! 131

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Figure 2: Event at 07:14 Hrs on 765 kV Gwalior-Agra circuit 1 & 2

- At 07:30: 36 Hrs Y-B phase to phase fault occurred on 765 kV Gwalior-Agra circuit 1 and it tripped. The same can be seen from Bina Bus voltage captured from PMU and Gwalior SOE.



Gwalior SOE

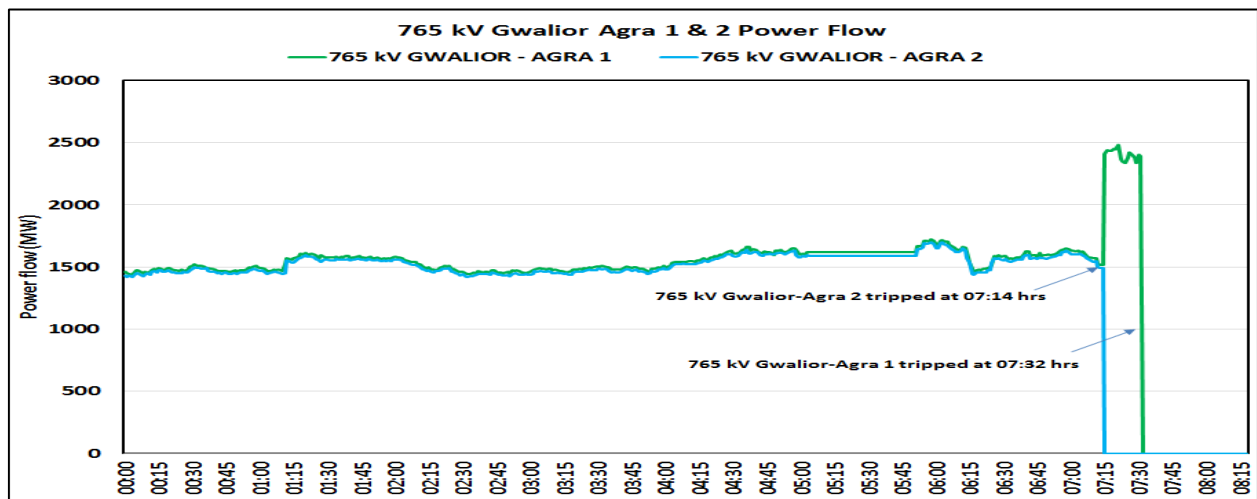
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GWR765 AGRA1ICT2TIESOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:30:36 ! 36
GWALIOR 220 SEB 1 SOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:30:36 ! 309
GWALIOR 220 SEB 3 SOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:30:36 ! 309
GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:30:36 ! 38
GWL400BINA1LR PRTCN SOE ! RSCC GWALIOR S 400 C ! Normal ! 14-01-2016 07:39:26 ! 51
GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Normal ! 14-01-2016 07:49:09 ! 824
GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 07:49:10 ! 335

```

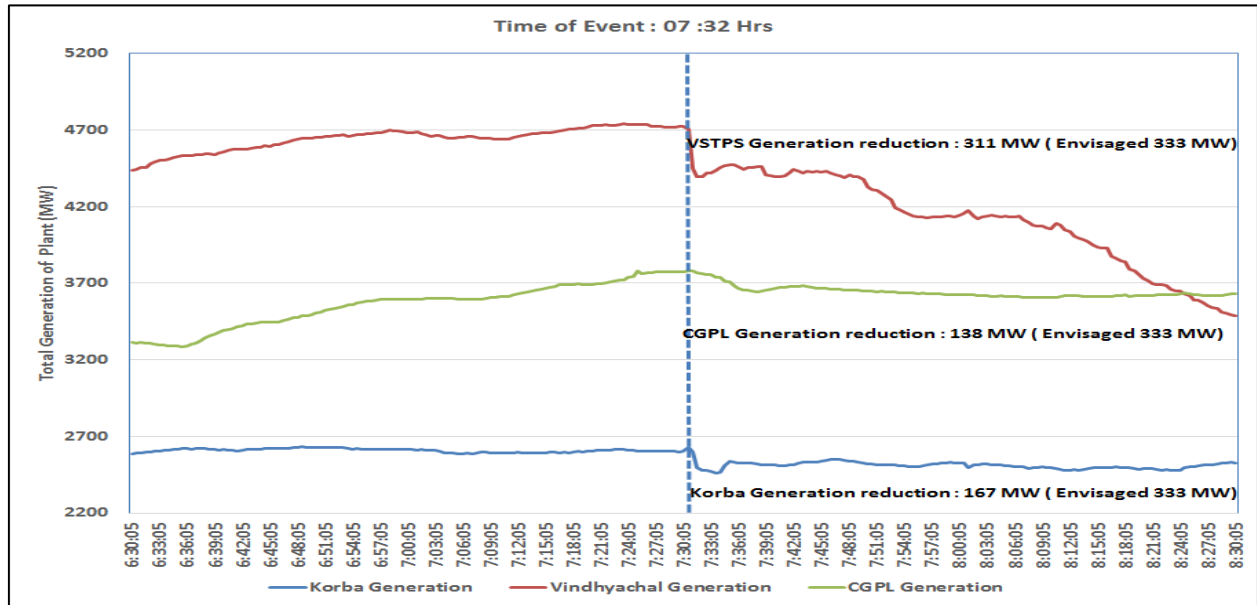
Figure 3: Event at 07:32 Hrs on 765 kV Gwalior-Agra circuit 2

With this tripping there was a simultaneous reduction of import by NR on 765 kV Gwalior Agra 1 & 2 by more than 1500 MW resulting in its SPS operation. This led to tripping of 220 kV Gwalior-Malanpur D/C and SPS signal for generation reduction at CGPL/Korba/Vindhyachal. The same can also be observed in the SOE.



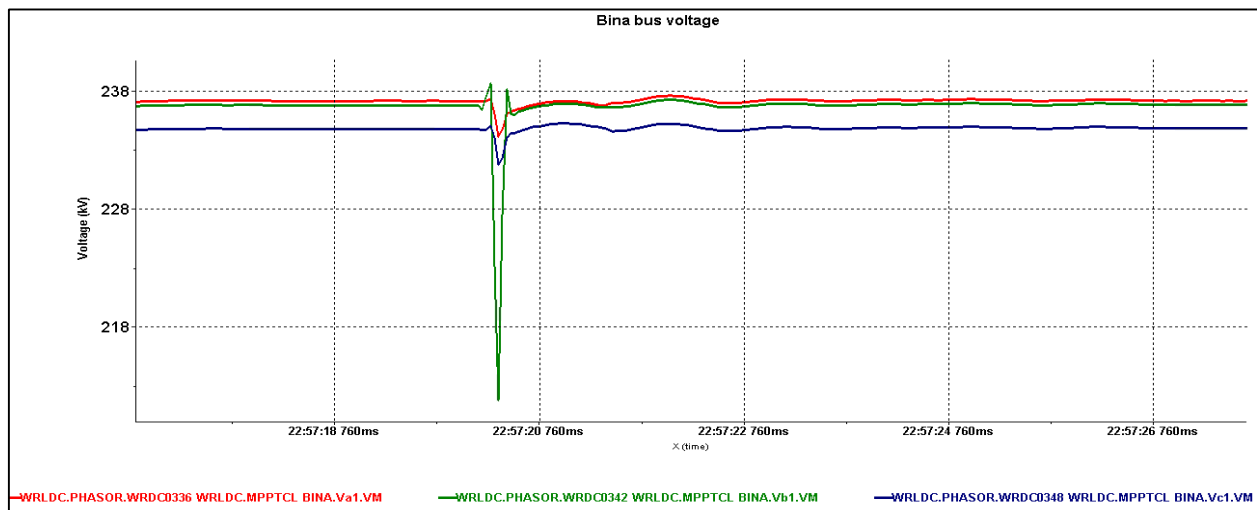
Backing down occurred in Western region generating station are as following:

1. Korba (Unit 7) : 167 MW
2. VSTPS(Unit 9,10) : 311 MW
3. CGPL (All units) : 138 MW
4. Total:-616MW against 1000MW envisaged.



Trial attempt were taken however the fault persisted and line tripped once again. The lines 2 were taken in service at 12:15 and Line 1 at 12:25 hrs.

4. At 22: 57 Hrs Y phase to earth fault occurred on 765 kV Gwalior-Agra circuit 1 and it got successfully auto-reclosed. The same can be seen from Bina Bus voltage captured from PMU and Gwalior SOE.



```

Gwalior SOE
GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 22:57:20 ! 384
GWR765 AGRA1ICT2TIESOE ! RSCC GWALIOR S 400 C ! Acted ! 14-01-2016 22:57:20 ! 385
GWR765 AGRA 1 SOE ! RSCC GWALIOR S 400 C ! Normal ! 14-01-2016 22:57:21 ! 432
GWR765 AGRA1ICT2TIESOE ! RSCC GWALIOR S 400 C ! Normal ! 14-01-2016 22:57:22 ! 461
    
```

Figure 4: Event at 22:57 Hrs on 765 kV Gwalior-Agra circuit 1

5. At 23: 02 Hrs B phase to earth fault occurred on 765 kV Gwalior-Agra circuit 2 and when auto-reclosed the fault persisted and line tripped. The same can be seen from Bina Bus voltage captured from PMU and Gwalior SOE.

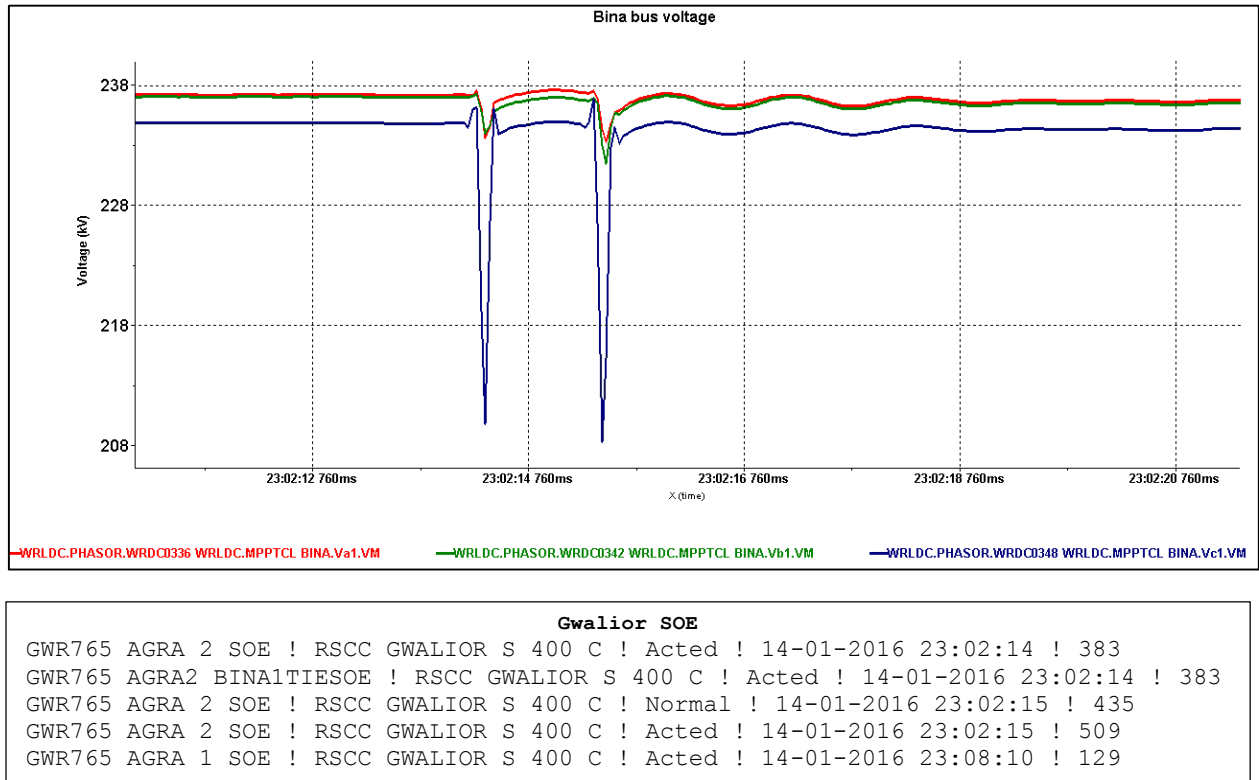


Figure 5: Event at 23:02 Hrs on 765 kV Gwalior-Agra circuit 2

6. At 23: 08 Hrs R phase to earth fault followed by Y phase to earth fault occurred on 765 kV Gwalior-Agra circuit 1 and line tripped. The same can be seen from Bina Bus voltage captured from PMU and Gwalior SOE.

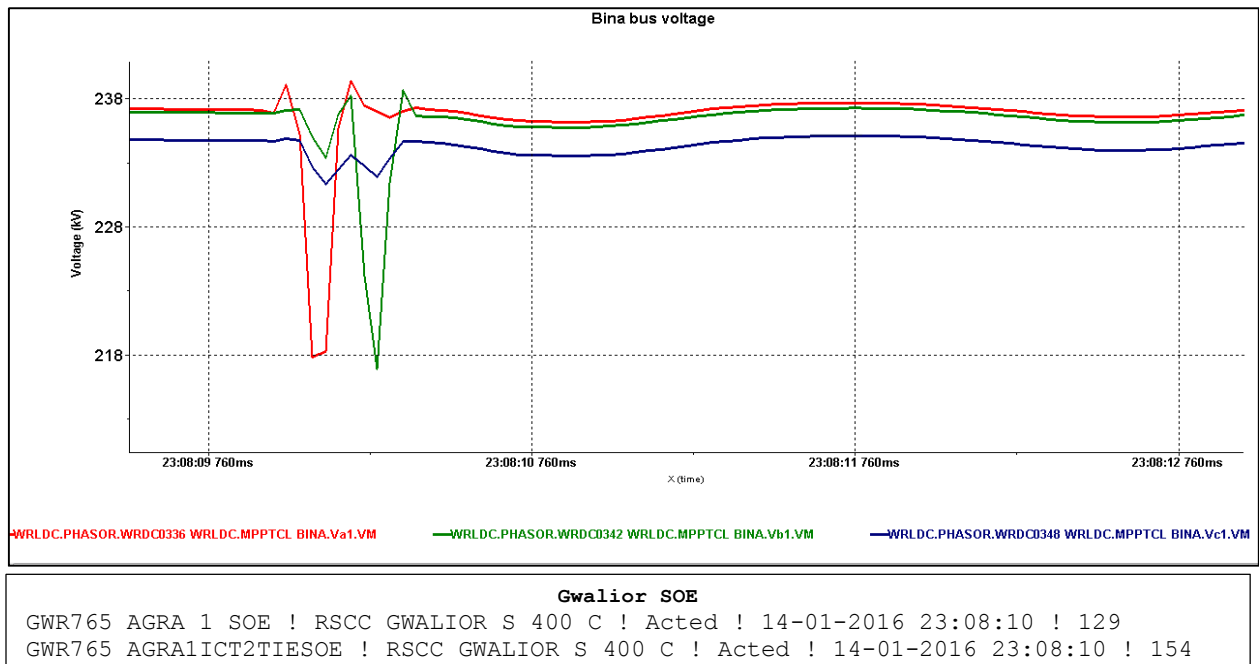
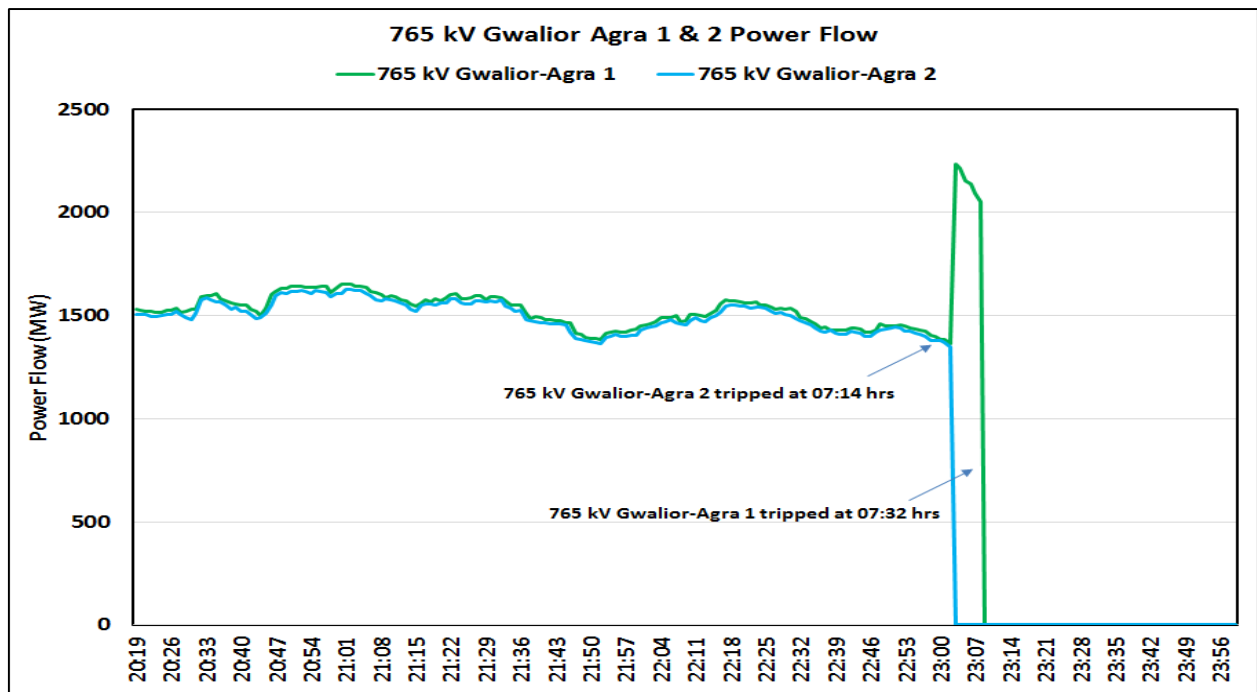
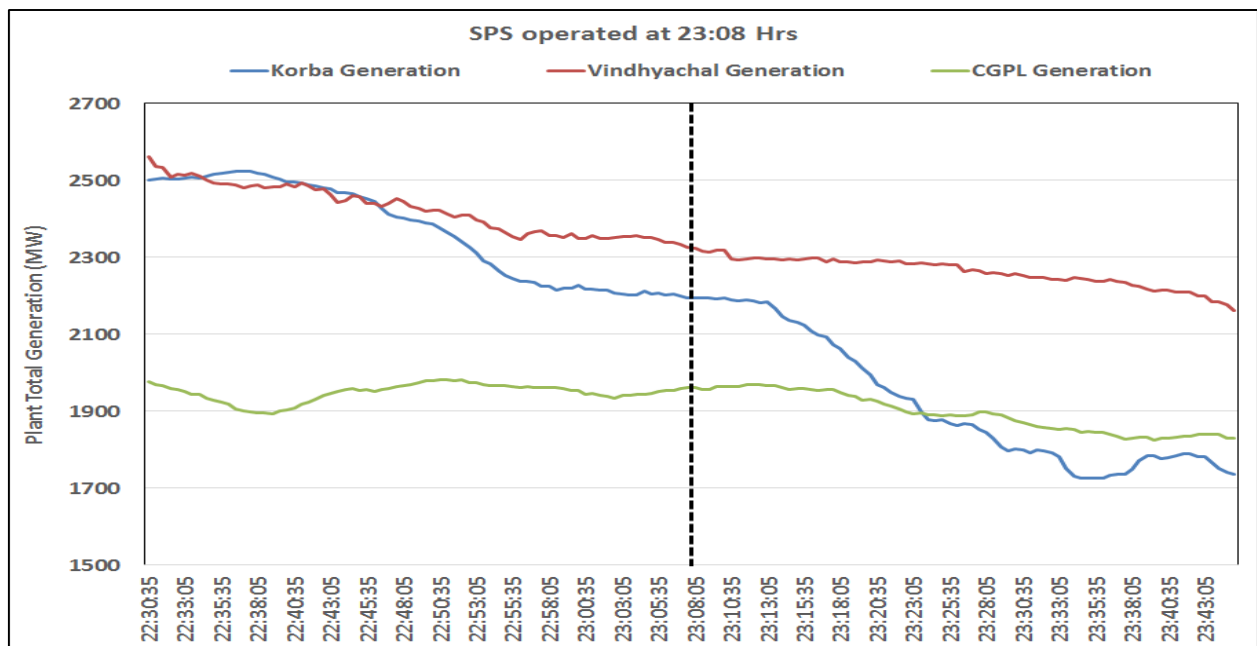


Figure 6: Event at 23:08 Hrs on 765 kV Gwalior-Agra circuit 1



With this tripping there was a simultaneous reduction of import by NR on 765 kV Gwalior Agra 1 & 2 by more than 1500 MW resulting in its SPS operation. This led to SPS signal for generation reduction at CGPL/Korba/Vindhyachal. The tripping signal to 220 kV Gwalior-Malanpur D/C were blocked prior to that. However this time no generation reduction occurred at CGPL/Korba/Vindhyachal.



Circuit 1 was restored on 15 Jan 2016 at 10:52 and circuit at 20:02 Hrs.

Observation:

NLDC vide letter dt. 07/09/2015 has intimated the revision in SPS in the WR-NR corridor. This was discussed in the meeting taken by WRPC on 16.10.15 and it was intimated that for reduction of import by NR on 765kV Agra-Gwalior ckt I & II by more than or equal to 3000MW, 1000 MW backing down has to be implemented by WR generators (Korba, V'chal, Sasan & CGPL-250MW each). Further, it was

suggested that till communication signal is extended to Sasan, Korba, V'chal and CGPL have to ensure backing down of 330MW each it was observed during the operation of SPS at 07:32 hrs on 14th Jan 2015 that only Vindhychal has implemented the revised scheme.

During the night hour operation of SPS at 23:08 Hrs, there was no generation backing down in WR resulting in stress in the grid.

Later in the 126th PCM meeting of WR, it was intimated that the 330 MW has been implemented in Korba as well as CGPL.

Annexure: report from MPPTCL and Disturbance recorder file**Pre-Fault Condition**

On dated 20.01.2016 at around 01:55 Hrs. MP System was normal and frequency of National Grid was 50.14 Hz. At 400 kV S/s Indore, all 400 kV feeders were in charged condition and normally loaded. 400/220 kV, 315 MVA ICT – I is out since 02.08.2015 and Double Main Transfer Bus scheme exists for 400 kV & 220 kV system at 400 kV S/s Indore.

Prior to fault feeder arrangement and loading of 400 kV feeders & 400/220 kV transformers at 400 kV S/s Indore were as follows:-

| 400 kV MAIN BUS – I | | | 400 kV MAIN BUS – II | | |
|---------------------|--|---------------|----------------------|---|---------------|
| S.No. | Name of Feeders/X'mers | Loading in MW | S.No. | Name of Feeders/X'mers | Loading in MW |
| 1. | 400/220 kV, 315 MVA ICT – III | 91 | 1. | 400/220 kV, 315 MVA ICT - II | 93 |
| 2. | 400 kV Indore – Itarsi (PGCIL) Ckt – I | -199 | 2. | 400/220 kV, 315 MVA ICT - IV | 95 |
| 3. | 400 kV Indore – ISP Ckt - I | -156 | 3. | 400 kV Indore – Itarsi (PGCIL) Ckt– II | -200 |
| 4. | 400 kV Indore –Indore (PGCIL) Ckt – I | -193 | 4. | 400 kV Indore – Indore (PGCIL) Ckt–II | -189 |
| 5. | 400 kV Indore – Nagda Ckt. | 287 | 5. | 400 kV Indore – Asoj (Gujarat) Ckt – I | 200 |
| | | | 6. | 400 kV Indore – Asoj (Gujarat) Ckt – II | 200 |

Occurrence

At around 01:59 Hrs. 400 kV Indore – Nagda Ckt tripped from both end due to 'R' - Phase disk failure at Loc No.-182 from 400 kV S/s Indore end. At 400 kV S/s Indore DPR operated and fault was cleared in 59 sec but zone I operation trip relay not dropped off for 350 ms. consequently LBB protection mal operated and hence Bus Bar Protection operated for 400 kV Main Bus – I at 400 kV S/s Indore, resulting in tripping of following feeders and transformers connected to 400 kV Main Bus – I at 400 kV S/s Indore.

| S.No. | Name of Feeder/transformer | Tripping End | Tripping Time | Indication |
|-------|----------------------------|--------------|---------------|---|
| 1. | 400 kV Nagda – Indore Ckt | Both End | 01:59 Hrs. | Nagda end:- MAIN I - R PH.TRIP, ZONE-I, 40.37 Km. MAIN II- R |

| | | | | |
|----|--|-------------------|------------|--|
| | | | | PH.TRIP, 39.50 Km. AR Lockout Indore end:- MAIN I - R PH.TRIP, ZONE-I, 72.30 Km MAIN II- R PH.TRIP, ZONE-I, 72.20 Km, LBB Relay Optd, AR Lockout. |
| 2. | 400/220 kV, 315 MVA ICT – III at 400 kV S/s Indore | 400 kV S/s Indore | 01:59 Hrs. | Bus Bar Protection operated. |
| 3. | 400 kV Indore – ISP Ckt – I | 400 kV S/s Indore | 01:59 Hrs. | Bus Bar Protection operated. |
| 4. | 400 kV Indore – Indore (PGCIL) Ckt – I | 400 kV S/s Indore | 01:59 Hrs. | Bus Bar Protection operated. |
| 5. | 400 kV Bus Coupler | 400 kV S/s Indore | 01:59 Hrs. | Bus Bar Protection operated. |

During the above tripping no interruption occurred in any area. Tripping details and relay indication furnished by Executive Engineer 400 kV Testing Division, MPPTCL, Indore are enclosed as – Annexure – I & II.

Remedial Measures

400 kV Main Bus – I at 400 kV S/s Indore was charged by charging 400 kV Bus Coupler at 02:44 Hrs. subsequently following feeders and transformers were charged:-

1. 400/220 kV, ICT – III at 400 kV S/s Indore – at 02:46 Hrs.
2. 400 Indore – ISP Ckt – at 02:52 Hrs.
3. 400 kV Indore – Itarsi Ckt – I at 03:04 Hrs.
4. 400 kV Indore – Indore(PGCIL) Ckt – I – at 03:11 Hrs.
5. 400 kV Indore – Nagda Ckt – at 16:26 Hrs.

Conclusion

The above tripping occurred due to 'R'- Phase disc failure of 400 kV Nagda – Indore Ckt and due to Mal-operation of LBB protection at 400 kV S/s Indore and not clearing fault by 350ms in time. Relay testing and coordination is required at 400 kV S/s Indore.

Load Loss

There was no Load Loss during the above tripping.

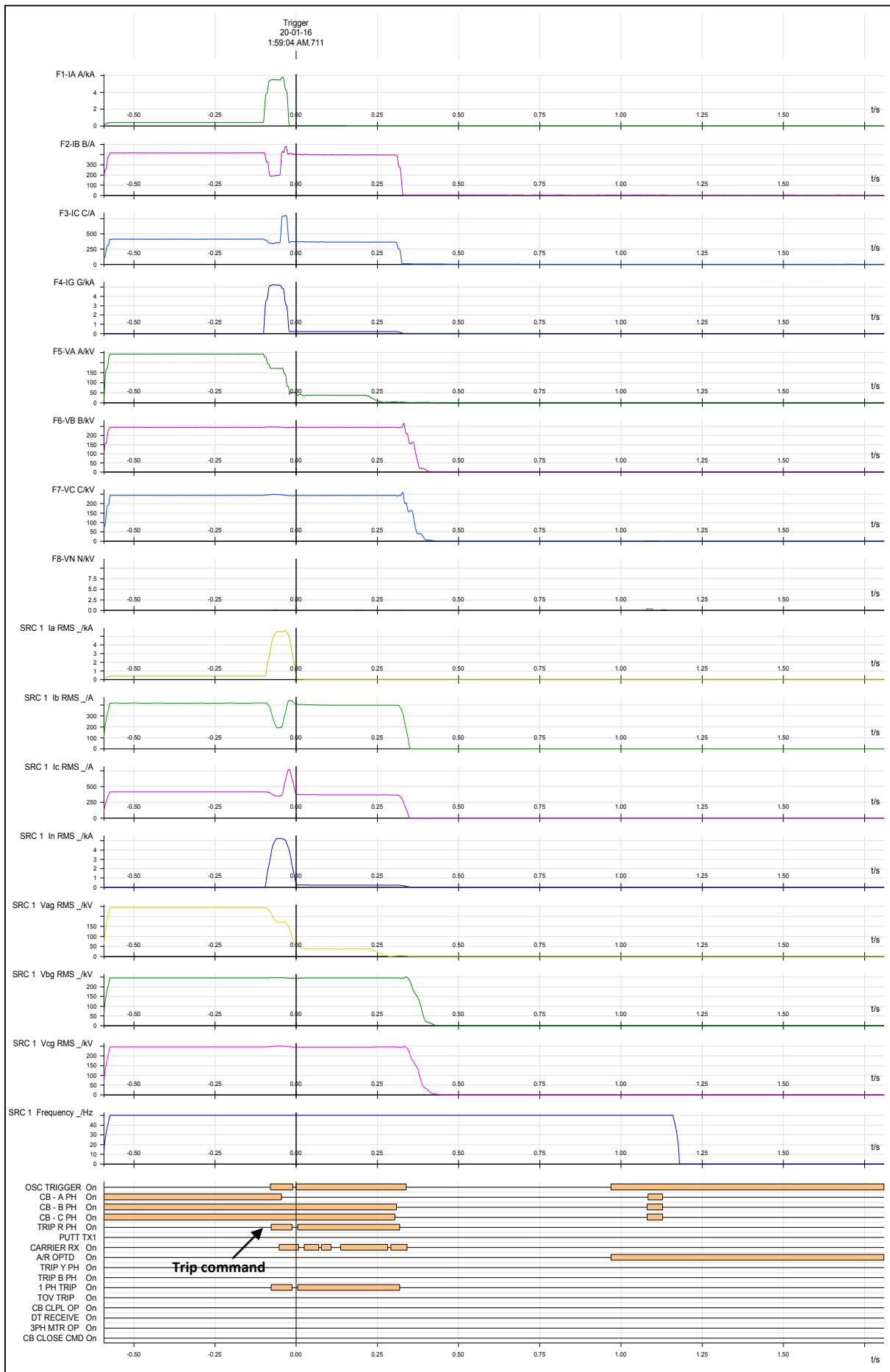


Fig : 400 kV Indore-Nagda 1 DR of Main 1 from Indore End.

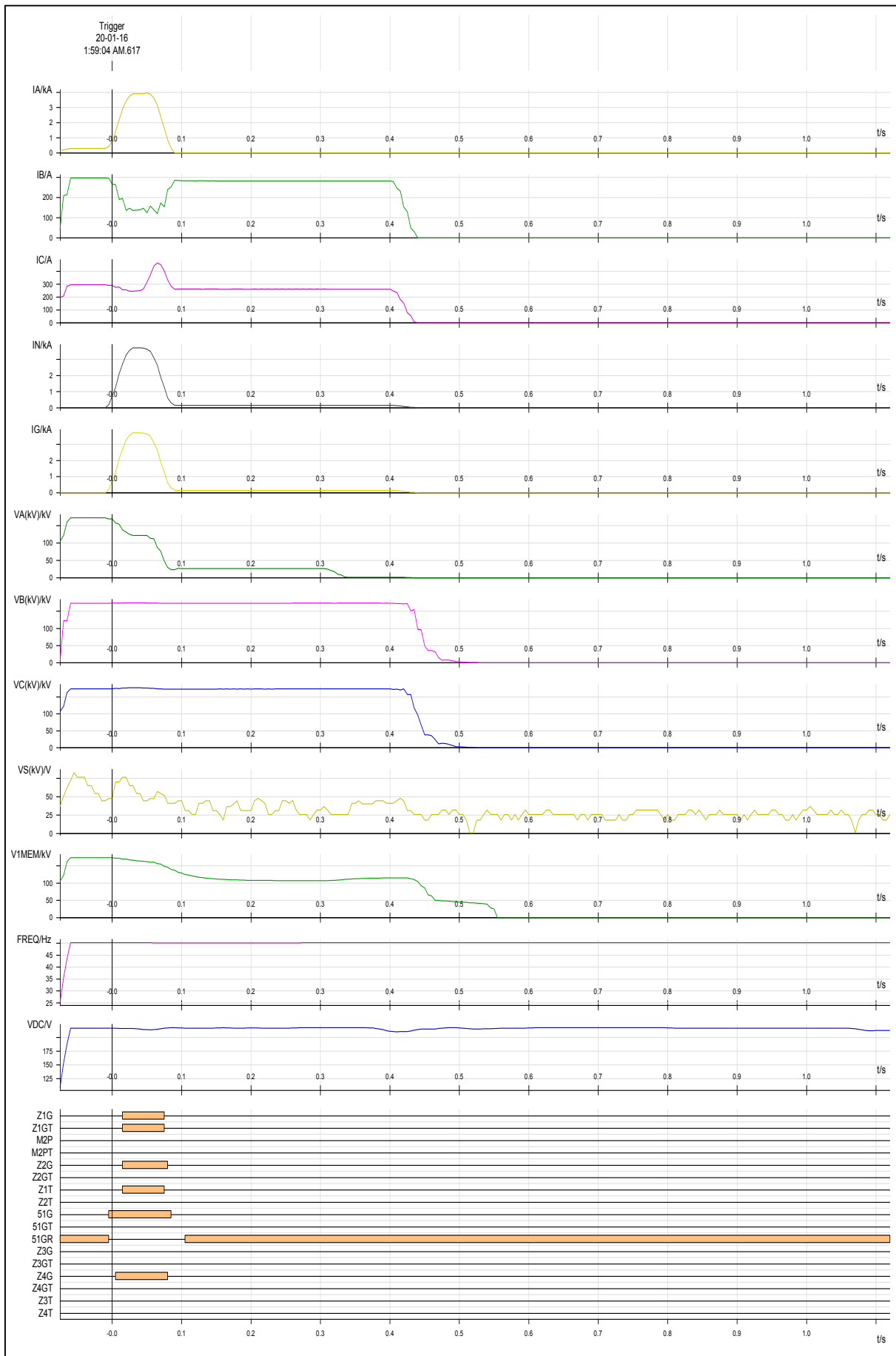


Fig: 400 kV Indore-Nagda 1 DR of Main 2 from Indore End.

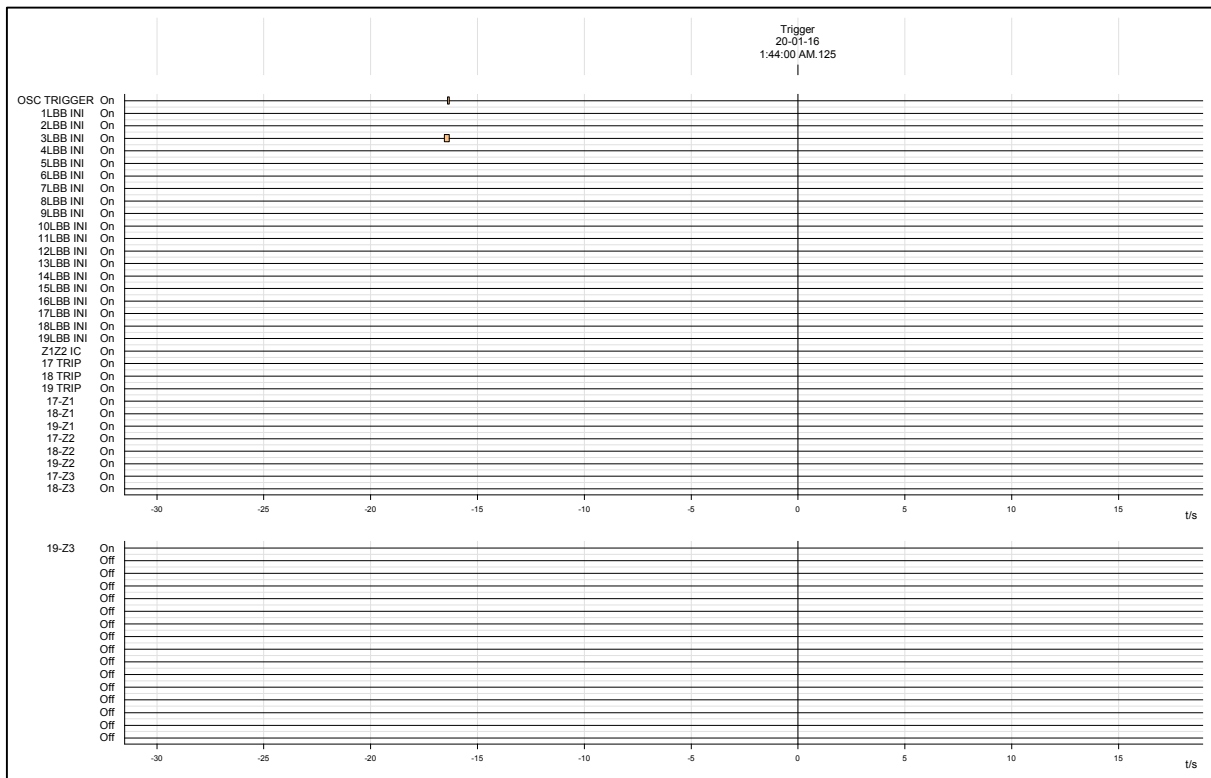


Fig: Bus bar protection relay and LBB scheme.

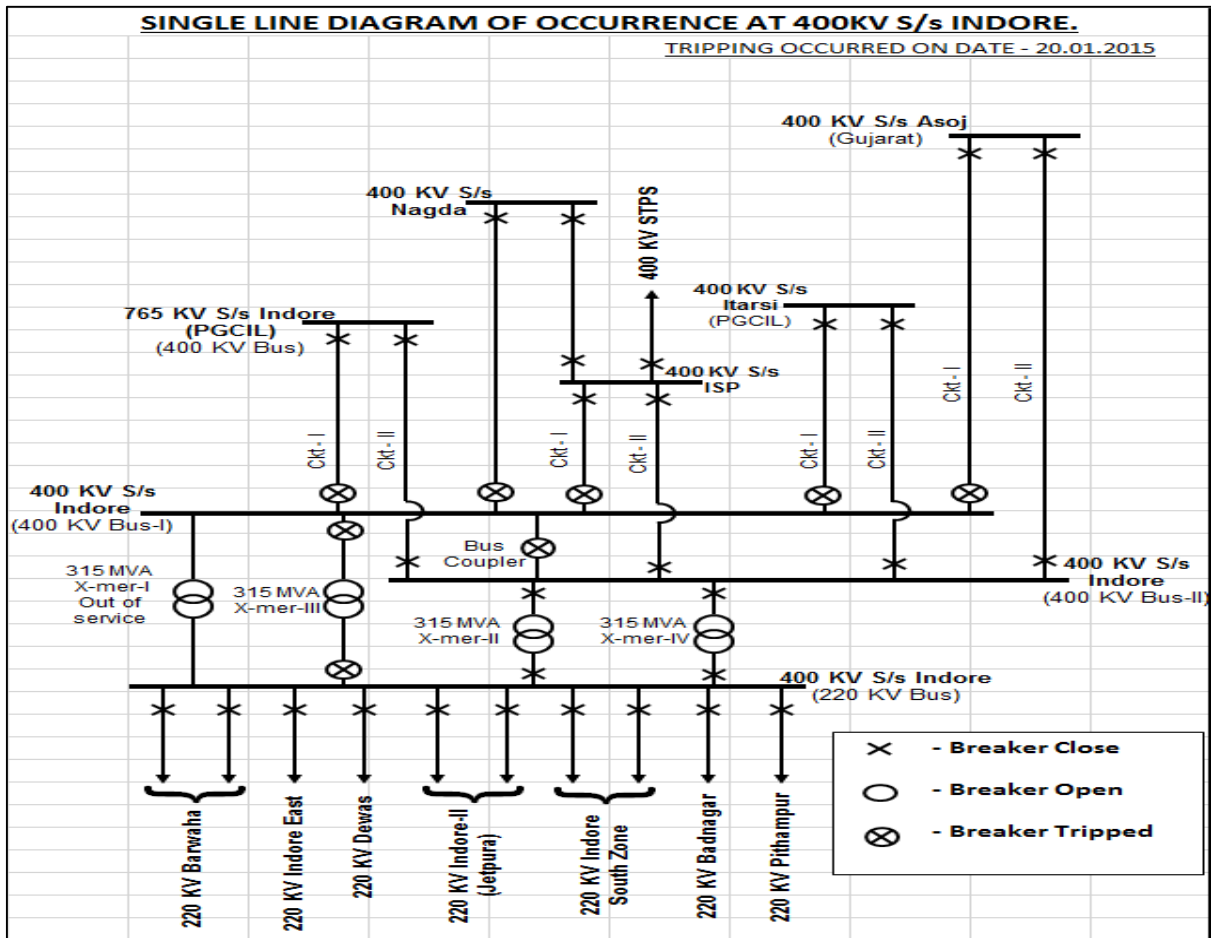


Fig: Single Line diagram

Grid Incidence at 765/400 kV Jabalpur PS on 24th December 2015

Event Category: GI-2

Event Date and Time: 24th December 2015, 05:00 Hrs

Event Summary: 765/400 kV ICT 1 & 2 at Jabalpur Sub-station tripped on over flux protection at 05:00 Hrs. This resulted in isolation of 765 kV and 400 kV Jabalpur PS Bus.

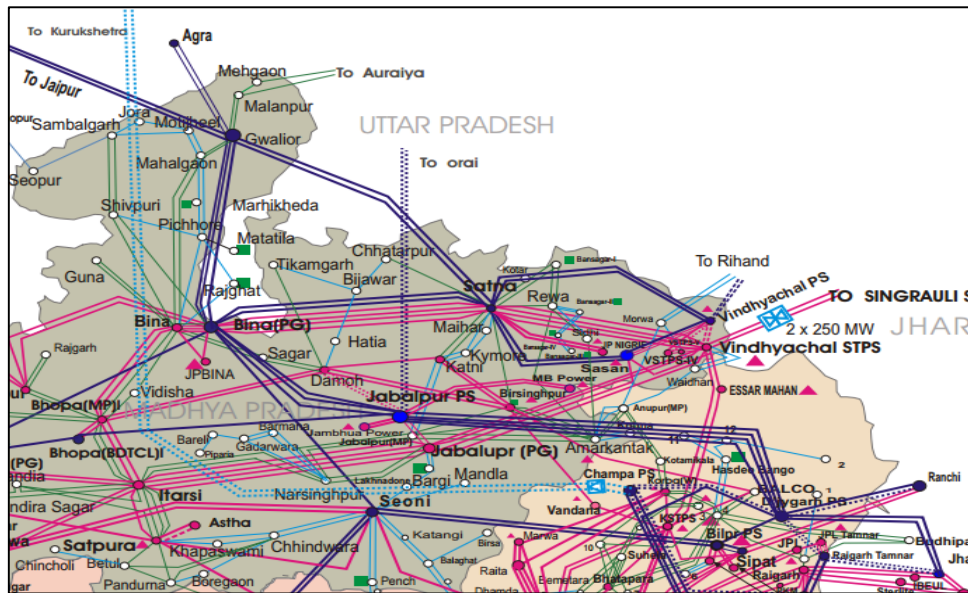


Figure 1 : Geographical Map

Event Overview and Analysis:

- 765 /400 kV Jabalpur PS Voltage were within IEGC Limit of 1.05 p.u.
- There was no intimation from sub-station or RTAMC regarding picking up of over flux protection.
- At 05:00 Hrs, the 765/400 kV ICT 1 & 2 at Jabalpur pooling station tripped on over flux protection causing separation of 765 and 400 kV Buses.
- Immediately voltages were checked by operator and everything was found in order and site was advised to check overflux protection.
- After this ICTs were restored by 07:01 Hrs .

Table 1 : Sequence of events

| Elements | Tripping Time | Relay Indication at End 1 | Relay indication at End 2 | Restoration Time |
|------------------|---------------|---------------------------|---------------------------|------------------|
| 765/400 kV ICT 1 | 05:00 | Intertrip | Over flux protection | 06:47 |
| 765/400 kV ICT 2 | 05:00 | Intertrip | Over flux protection | 07:01 |

* Based on WRLDC SCADA SOE/PMU

Event Analysis: DR/ EL has not been received from PGCIL WRTS-2 causing non-compliance of IEGC 5.2.r and CEA grid standard 15.3 regulatory provisions. Submission of DR/EL has been emphasized by WRLDC and Protection forum of Western region in the past. Such delay in details causes difficulties in the analysis of event and sharing of lessons learnt thereafter. Therefore the event was analyzed based on the SCADA input available at WRLDC.

Over flux setting (V/f) of ICTs are in general set as following:

- Stage 1: 110 % of Rated voltage /50 Hz for 9000 Sec (Call it as 1 p.u.)
- Stage 2 : 118% of Rated voltage /50 Hz = 1.072 p.u. for 90 Sec
- Stage 3 : 126% of Rated voltage /50 Hz = 1.145 p.u. for 49.5 sec
- Stage 4 : 134% of Rated voltage /50 Hz = 1.218 p.u. for 18 sec
- Stage 5 : 142% of Rated voltage /50 Hz = 1.291 p.u. for 4 sec

As observed from SCADA plot in figure 2, the voltage for Jabalpur Pooling station at 765 and 400 kV level were well below 1.06 p.u. Further the frequency were also not low during the period as shown in figure 3. The V/f ratio for 400 kV Bus of Jabalpur PS was well below 95 % of the stage 1 value for all the time prior to tripping as shown in figure 4. This indicate that the setting has been kept low which could have resulted in over flux tripping on ICTs.

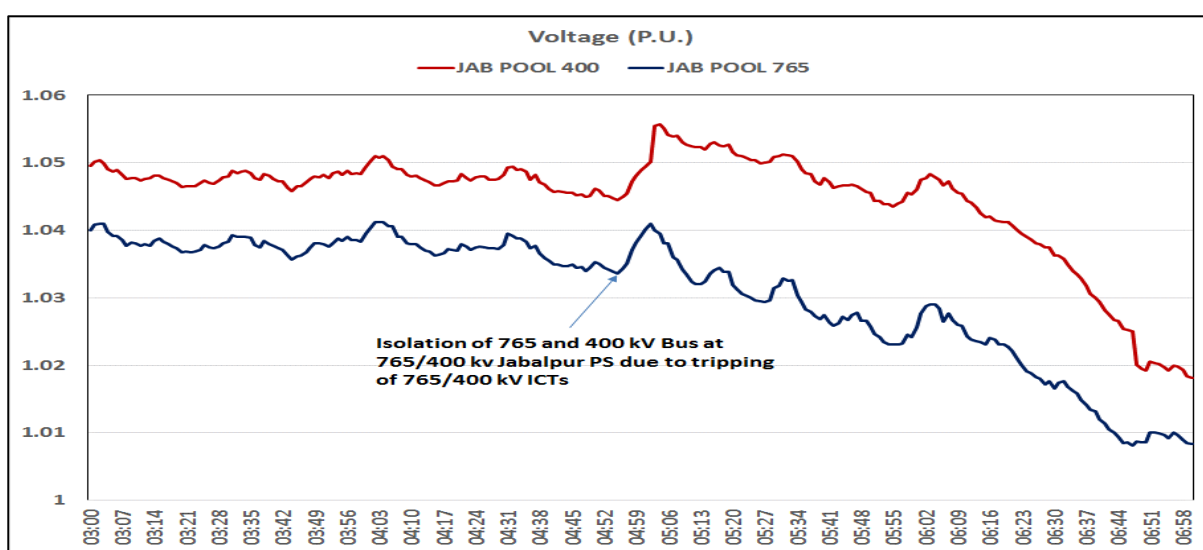


Figure 2 : 400 and 765 kV Bus voltage of Jabalpur PS

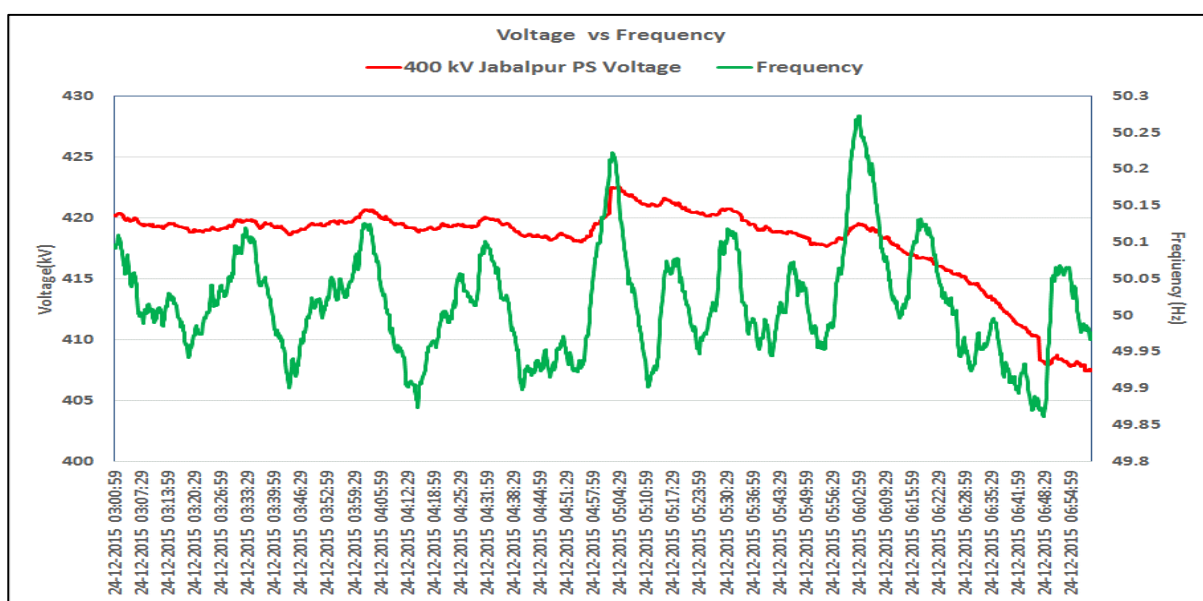


Figure 3 : 400 kV Bus voltage of Jabalpur PS and Frequency

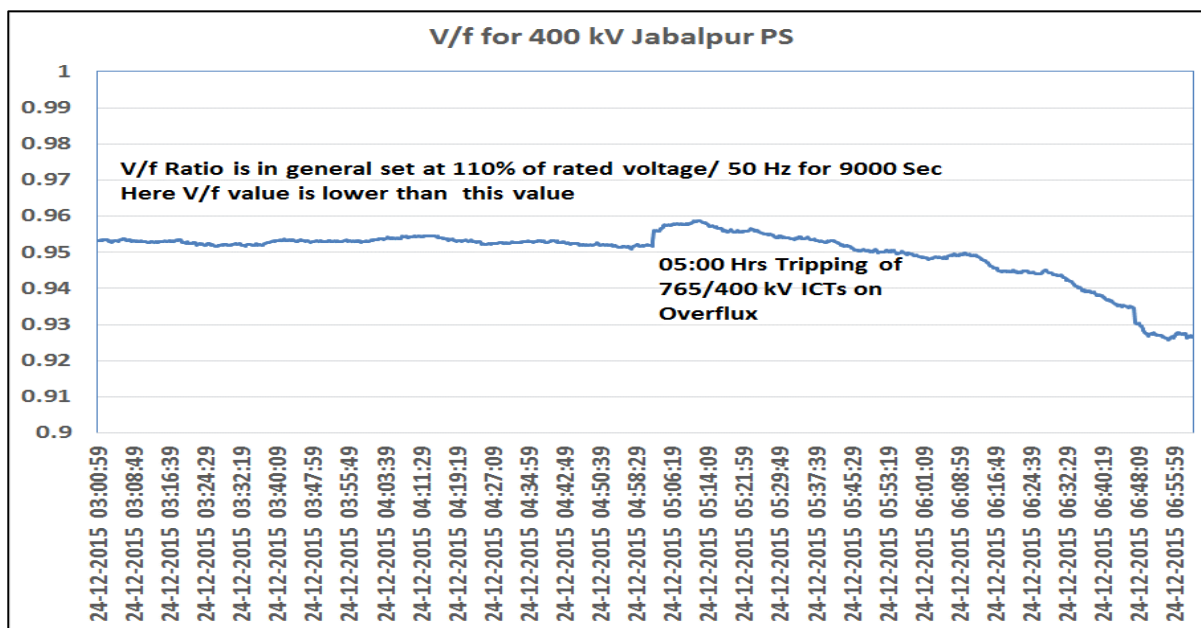


Figure 4 : V/f Ratio for 400 kV Jabalpur Pooling Bus (Taking stage 1 setting as 1.p.u. 110 % of rated voltage / 50 Hz as nominal frequency)

Protection and Operation Related Issues:

| Issues | Protection clause applicable | Agency |
|---|---|--------------|
| DR/EL to not provided within 24 Hours | 1. IEGC 5.2 (r) 2. CEA grid Standard 15.3 | PGCIL WRTS-2 |
| Non-submission of Details for the tripping which is required for appropriate analysis for GD/GI | 1. IEGC 5.2 (r), 5.9.6.c (VI) 2. CEA grid Standard 15.3 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007-6. 4.d | PGCIL WRTS-2 |

Remarks:

1. It was observed that the tripping of 765/400 kV ICTs were not desirable. The reason for tripping may be the lower setting of over flux relay which may kindly be checked. A detailed analysis of the event may kindly be submitted to WRLDC/WRPC along with DR and EL.
2. It was further observed that there were no alarm reported to WRLDC by the RTAMC/Sub-station which was not desirable. Such alarm helps in early detection of such over flux phenomenon. This may also be kindly checked from event logger and sub-station.
3. PGCIL WR-2 is advised to send DR/EL for any tripping to WRLDC/WRPC within 24 Hour as per the mandates of Regulations by CERC and CEA.

Grid Incidence at 400 kV Vindhyachal Sub-station on 28th December 2015

Event Category: GI-2

Event Date and Time: 28th December 2015, 02:29 Hrs

Event Summary: While withdrawal of the Vindhyachal Unit 8, its breaker got stuck and LBB operated at 02:29 hrs resulting in tripping of Vindhyachal Bus section 4 along with its elements 400 kV Vindhyachal-Jabalpur 2, Vindhyachal-Satna 2, Korba-Vindhyachal, Bus Reactor 2 and IBT 1. During the event there was no load/generation loss.

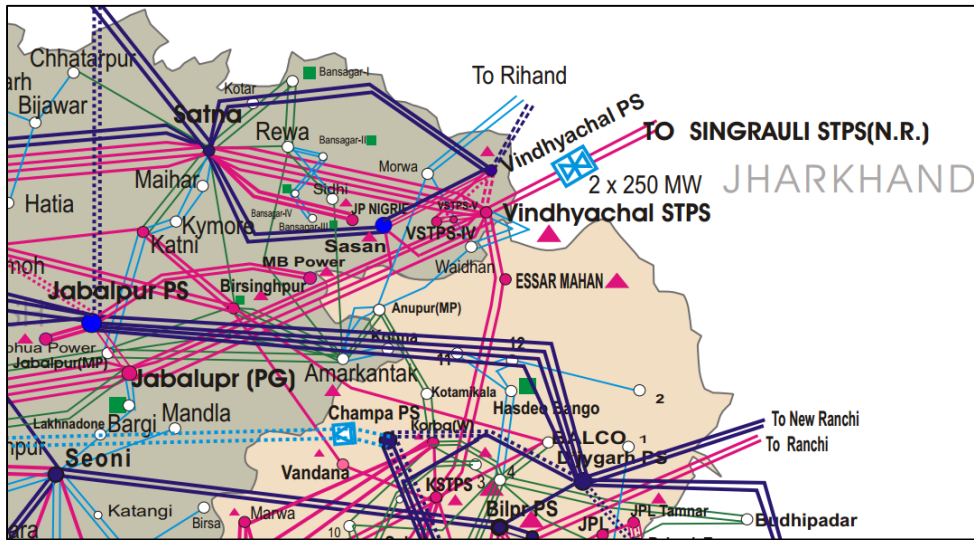


Figure 1 : Geographical Map

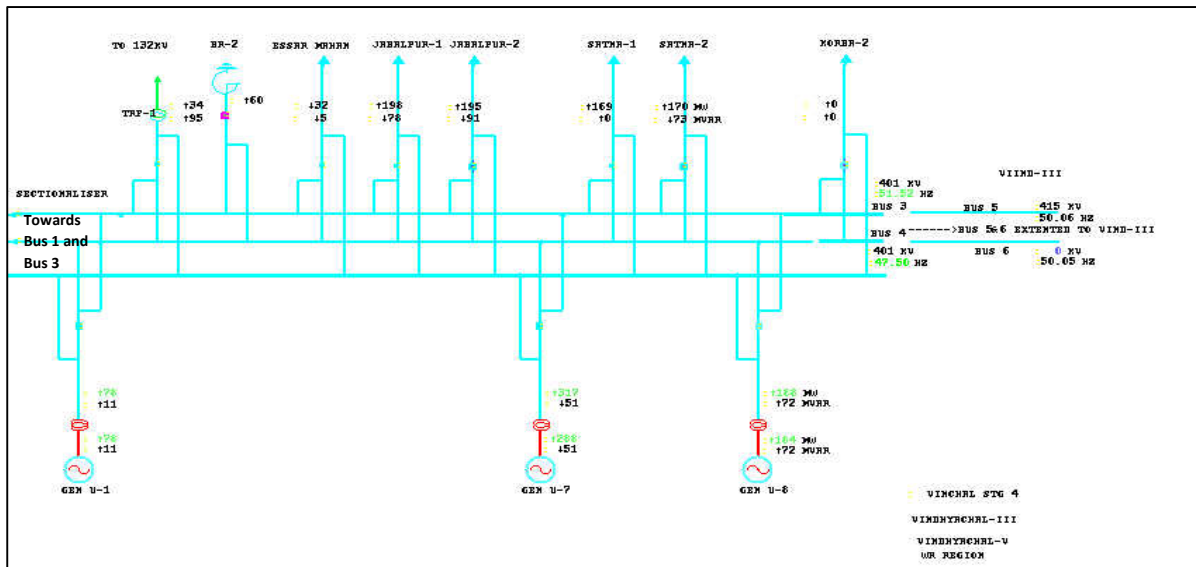


Figure 2 : SLD of Bus Section 3 and 4

Event Overview and Analysis:

- It was observed that Bus section 4 of Vindhyachal tripped while withdrawal of Unit 8. NTPC Vindhyachal informed that LBB of Unit 8 has operated due to stuck breaker. This led to tripping of all connected element on Bus section 4.
- The SCADA SOE and Relay indication based on WRLDC Flash Report is given in table 1 and 2 respectively.

Table 1 : WRLDC SCADA Sequence of Event

| Name of Element | Station | Status | Time |
|--------------------------|-----------------------|---------|-------------|
| STNA VINCHL 2 400 CB | RSCC SATNA S 400 C | Open | 2:28:26.023 |
| STNA VIN2-BN2 TIE 400 CB | RSCC SATNA S 400 C | Open | 2:28:26.026 |
| VNCHL SATNA 2 400 CB | RSCC VSTPS S 400 C | Open | 2:29:30.277 |
| KTPS VDCYNL 2 400 CB | RSCC KSTPS S 400 C | Transit | 2:29:30.446 |
| KTPS VDCYNL 2 400 CB | RSCC KSTPS S 400 C | Faulty | 2:29:30.449 |
| VNCHL BUSSEC 2 400 CB | RSCC VSTPS S 400 C | Faulty | 2:29:30.285 |
| VNCHL 400/132P 1 CB | RSCC VSTPS S 400 C | Faulty | 2:29:30.282 |
| VNCHL BSREAC 1 400 CB | RSCC VSTPS S 400 C | Faulty | 2:29:30.280 |
| JPUR VIN 2-3 TIE 400 CB | RSCC JABALPUR S 400 C | Open | 2:29:30.472 |
| JBPUR VINCHL 2 400 CB | RSCC JABALPUR S 400 C | Open | 2:29:30.386 |
| VNCHL BSREAC 1 400 CB | RSCC VSTPS S 400 C | Open | 2:29:30.297 |
| VNCHL BUSSEC 2 400 CB | RSCC VSTPS S 400 C | Open | 2:29:30.296 |
| VNCHL 400/132P 1 CB | RSCC VSTPS S 400 C | Open | 2:29:30.289 |

Table 2 : Relay indication and Details of Restoration

| Elements | Tripping Time | Relay Indication at End 1 | Relay indication at End 2 | Restoration Time |
|---|---------------|---------------------------|---------------------------|------------------|
| Vindhyachal Bus Section 4 | 02:29 | LBB optd. | | 06:32 |
| Vindhyachal Bus Sectionalizer for 2 & 4 | 02:29 | LBB optd. | | 06:32 |
| 400 kV Vindhyachal-Jabalpur 2 | 02:29 | LBB optd. | Not Available | 06:46 |
| 400 kV Vindhyachal-Satna 2 | 02:29 | LBB optd. | Not Available | 06:53 |
| 400 kV Vindhyachal-Korba | 02:29 | LBB optd. | Not Available | 07:10 |
| 400/132 kV IBT 1 | 02:29 | LBB optd. | Not Available | 06:32 |
| Bus reactor | 02:29 | LBB optd. | Not Available | 06:32 |

* Based on WRLDC SCADA SOE/PMU/Flash Report

Restoration: There was no load/generation loss during the event. Restoration started after checking of yard and resting of relays. Bus Section 4 was taken in service by closing Bus sectionalizer CB at 06:32 and all elements were restored by 07:10 Hrs. Restoration details can be seen in table 2.

Protection and Operation Related Issues:

- Even after several intimation to NTPC, No details has been furnished for this event.. **(No details from Vindhyachal where event occurred, No DR from Korba for Vindhyachal-Korba trip)**
- Even the remote end sub-station of PGCIL WR-2 which are Jabalpur and Satna for the line tripping from their end has been received.
- Such non-sending of DR/EL for 400 kV elements tripping to WRLDC is not desirable in view of system security and its reliability. Also this are non-compliance of Indian Electricity Grid code 5.2.r and CEA grid standard 15.3. Even after so many reminder, utilities are not adhering to the grid code and standard which becoming a challenge for WRLDC during event analysis. Further,

this is not desirable in view of events and its analysis as recommended in the report of Ramakrishna Committee.

| Issue | Non-Compliance of Regulations | Utility |
|---|---|---------------------|
| Non-submission of preliminary Report from User, STU,CTU,SLDC to RLDC | 1. IEGC 5.9.6.a 2. CEA Grid Standard 12.2 (Applicable for SLDC,ALDC only) | NTPC |
| DR/EL not provided within 24 Hours | 1. IEGC 5.2 (r) 2. CEA grid Standard 15.3 | NTPC, PGCIL WR-2 |
| Non-submission of details for the tripping which is required for appropriate analysis for GD/GI | 1. IEGC 5.2 (r), 5.9.6.c (VI) 2. CEA grid Standard 15.3 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007-6. 4.d | NTPC, PGCIL WR-2 |

Remarks:

- Both utilities are advised to adhere the regulatory provision of sending of DR/EL and tripping analysis details of WRLDC/WRPC in the time line described in the regulation.

Detailed report of the occurrence at 400/220 kV Bina MP Sub-Station on 15th January 2015

1. **Event Category :** GD-1
2. **Event Date and Time:** 15th January 2015, 15:33 Hrs.
3. **Event Summary:** While shifting 400//200 kV ICT 3 at Bina (MP) at 15:33 hrs from 220 kV Main Bus 1 to 220 kV Bus 2, 220 kV Bus 2 side isolator of 400/220 kV has led to current mismatch/load impedance in phases resulting in tripping of all the ICTs and Incoming 220 kV lines on E/F indication. This led to loss of supply at 220 kV and nearby area causing load loss of 475 MW.

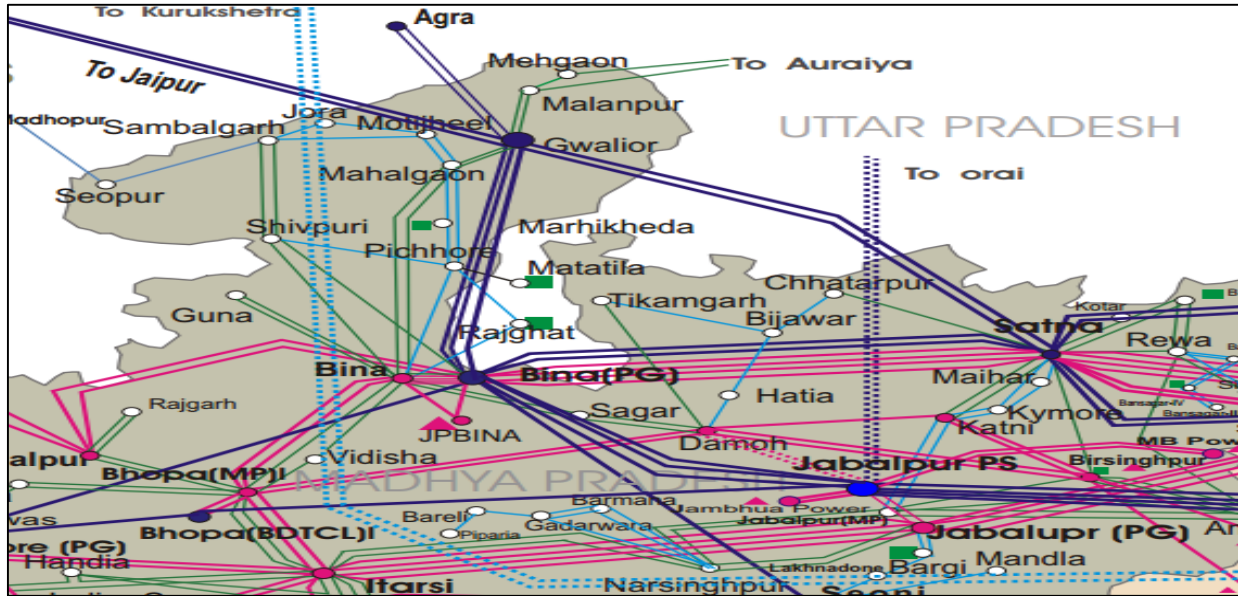


Figure 1 : Geographical Network Diagram

4. The antecedent conditions at 15:30 Hrs

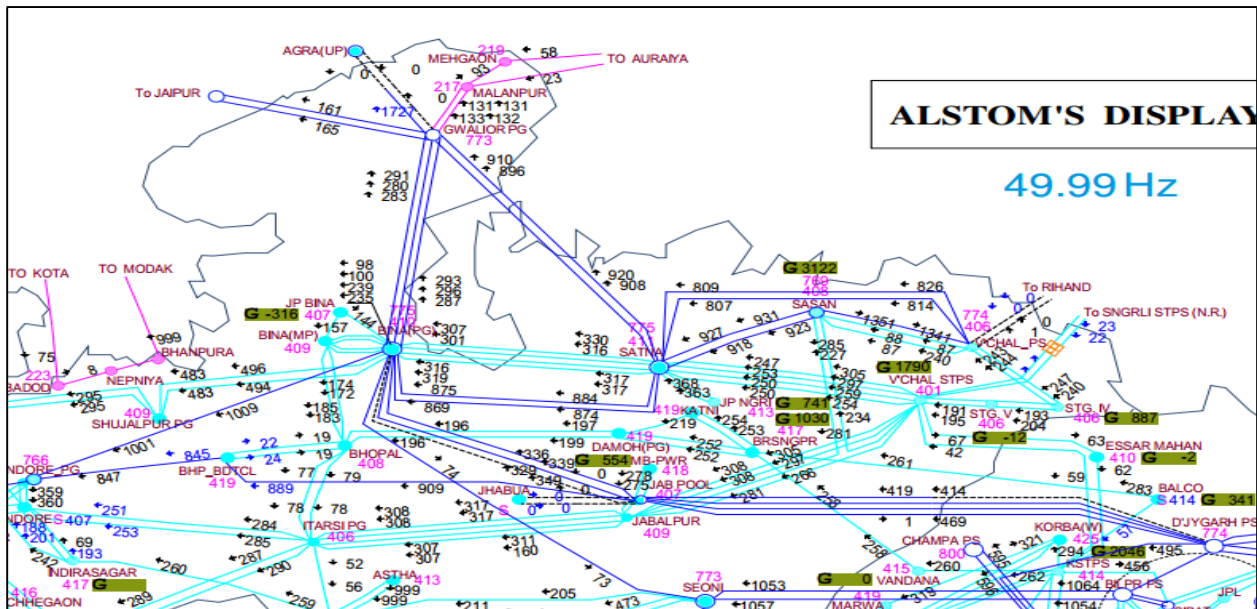


Figure 2 : SCADA overview of Bina (MP) and nearby area prior to event at 15:30 Hrs.

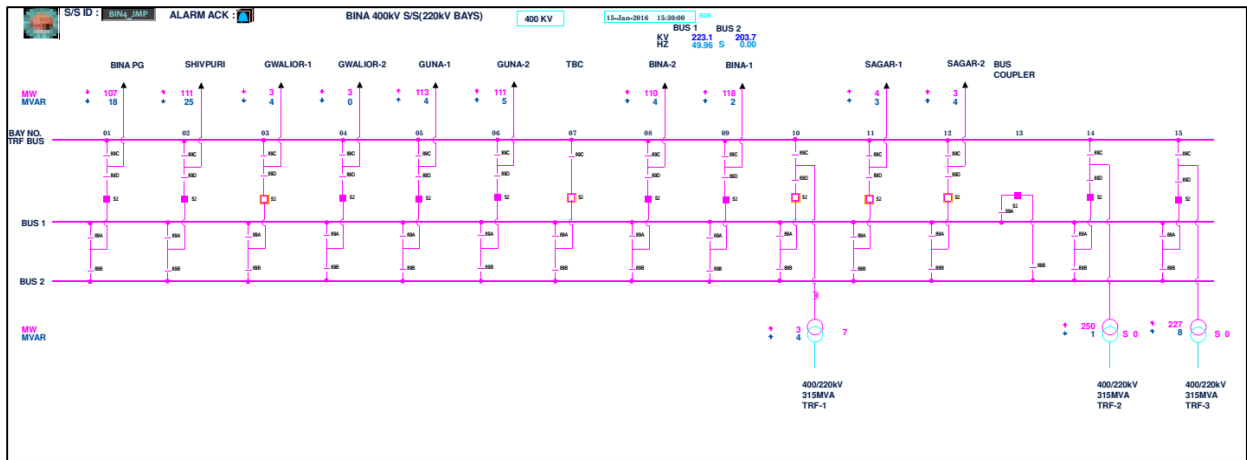


Figure 3 : SCADA overview of 220 kV bus of 400/220 Bina (MP) and nearby area prior to event at 15:30 Hrs.

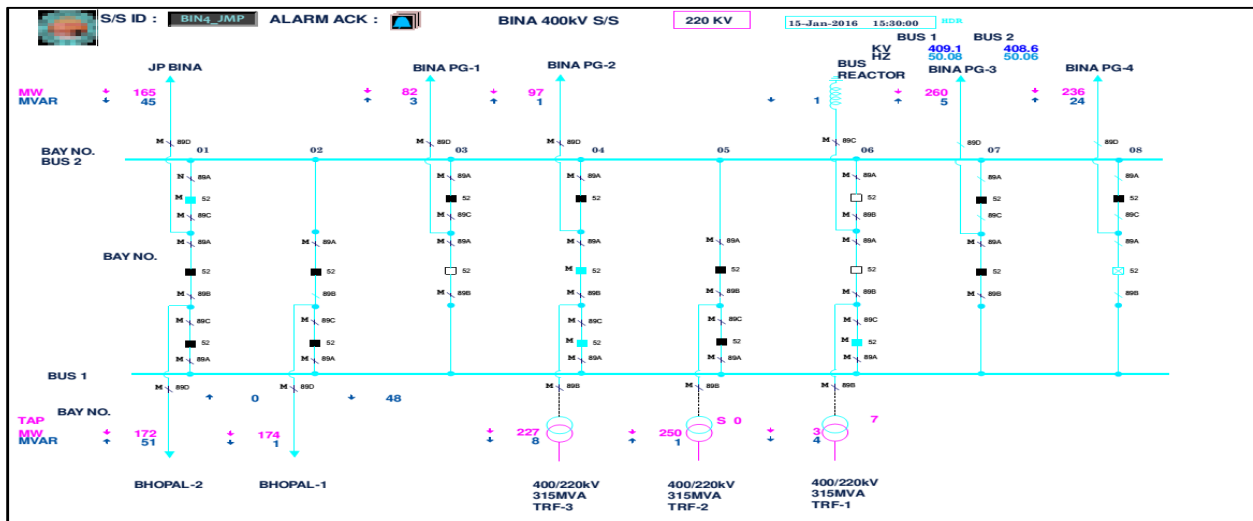


Figure 4 : SCADA overview of 400 kV bus of 400/220 Bina (MP) and nearby area prior to event at 15:30 Hrs.

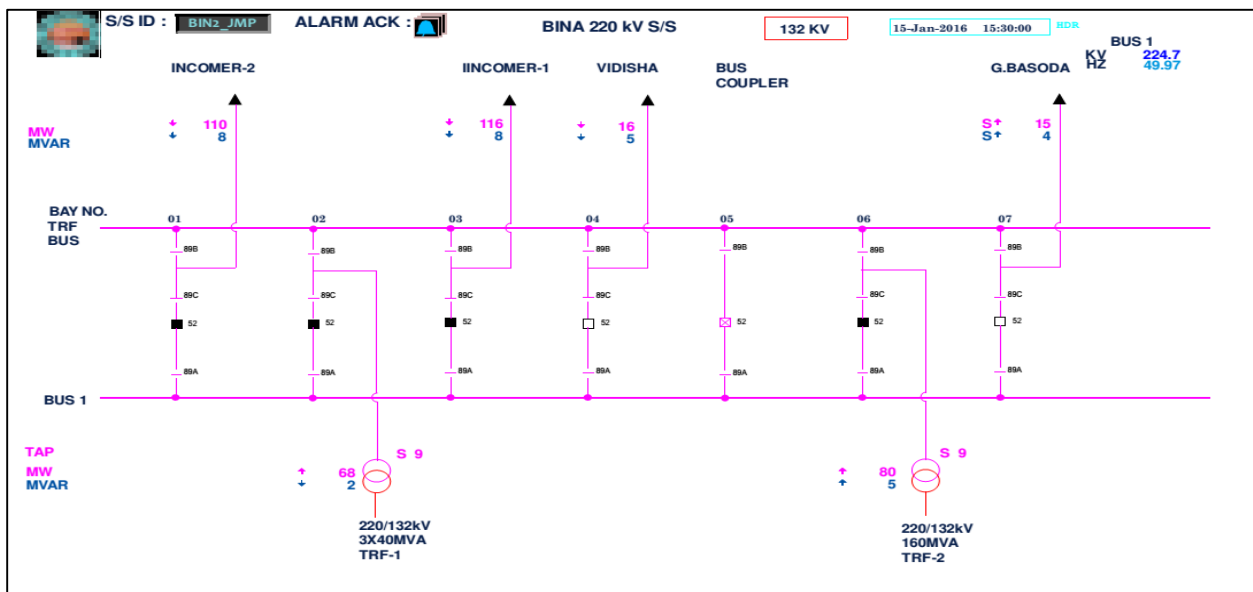


Figure 5 : SCADA overview of 220 kV bus of 220/132 Bina (MP) and nearby area prior to event at 15:30 Hrs.

5. Event Overview:

At 400/220 kV Bina (MP) S/s, new 400/220 kV, 315 MVA ICT 2 was connected recently on 04.01.2016. Due to the difference in % impedance of 400/220 kV, 315 MVA ICT 2 & 3 the load was not equally shared by both the ICT's. In order to balance the loading of both 220 kV Main Buses at 400/220 kV Bina (MP) S/s, Bus exchange operation of 400/220 kV, 315 MVA ICT 3 from 220 kV Main Bus 1 to 220 kV Main Bus 2 was being carried out. During this process, due to the 220 kV Main Bus 2 side isolator of 400/220 kV has caused current/load impedance mismatch in the 315 MVA ICT 3 resulting in tripping of lines and ICTs on E/F indication as given in Table 1. The mismatch may have been due to inherent delayed opening of one of the three phase isolator while transfer was going on. This has resulted in loss of supply at 220 kV Bina and radial connected station causing 475 MW load loss.

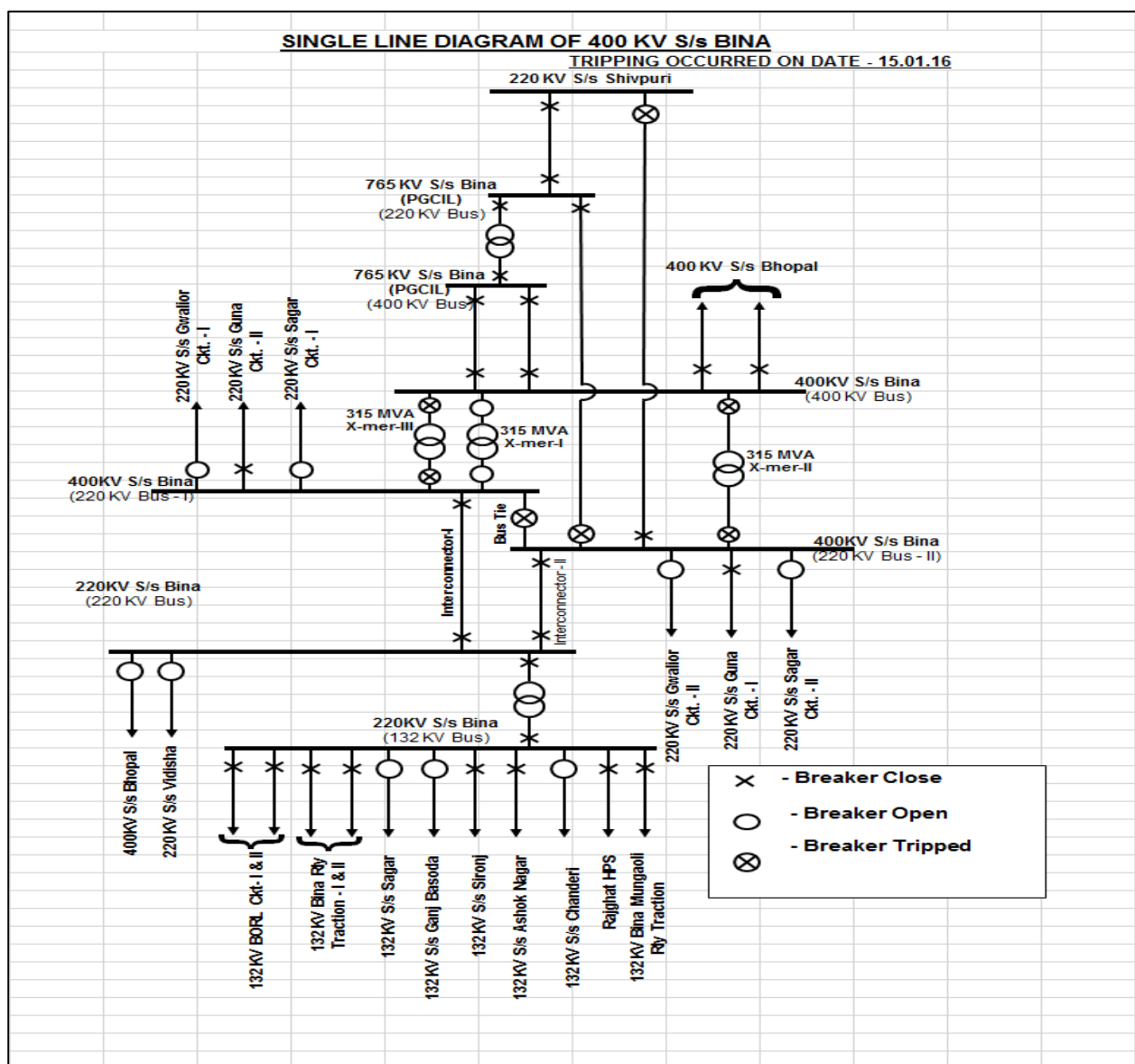


Figure 6 : SLD indicating breaker operation due to protection during the event (Source : MP SLDC)

Table 1 : The sequence of tripping and restoration

| Sl No. | Name of the transmission element/ Unit | Time of Tripping (hh:mm) | Relay indication End 1 | Relay Indication End 2 | Time of restoration (hh:mm) |
|--------|--|--------------------------|---------------------------|----------------------------------|-----------------------------|
| 1 | 400/220 kV, 315 MVA ICT 2 | 15:35 | | E/F | 16:05 |
| 2 | 400/220 kV, 315 MVA ICT 3 | 15:35 | | E/F | 17:25 |
| 3 | 220 kV Bus coupler | 15:35 | E/F | | N/A |
| 4 | 220 kV Bina (MP) – Bina (PGCIL) | 15:35 | Master trip, DT Received. | DEF opt., DT Send. | 17:05 |
| 5 | 220 kV Bina – Bina Interconnector 1 | 15:35 | H/T | C/B L/O, 186A, 186B. | 16:15 |
| 6 | 220 kV Bina – Shivpuri | 15:35 | H/T | DPR Optd., trip Phase-ABC, Z-III | 17:45 |

(Source MPPTCL)

Load / Generation affected: Load loss during the event was 475 MW.

Frequency Change : Frequency rose from 50.043 Hz to 50.107 Hz i.e. by 0.056 Hz. Power number observed during the event was 8482 MW/Hz.

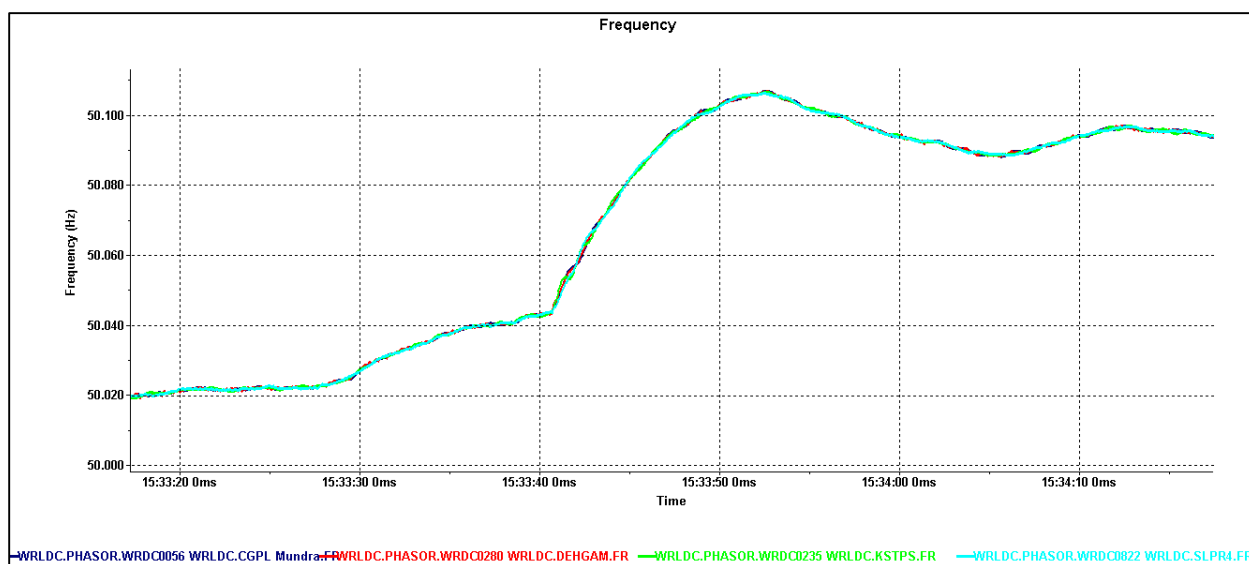


Figure 7 : Frequency during the event observed from PMU.

Restoration: Restoration details are provided on the report of MP SLDC attached as annexure.

6. Analysis: From the 400 kV Bina(MP) PMU data for Bus voltage and current for 400 kV Bina-Bina(PG) 1 and 400 kV Bina-Bhopal 1 circuit, unbalancing in the system is observed. Also, from the DR of 220 kV Bina-Bina (PG) circuit from Bina (PG) end is indicating imbalance and neutral current flow causing earth fault protection to operate.

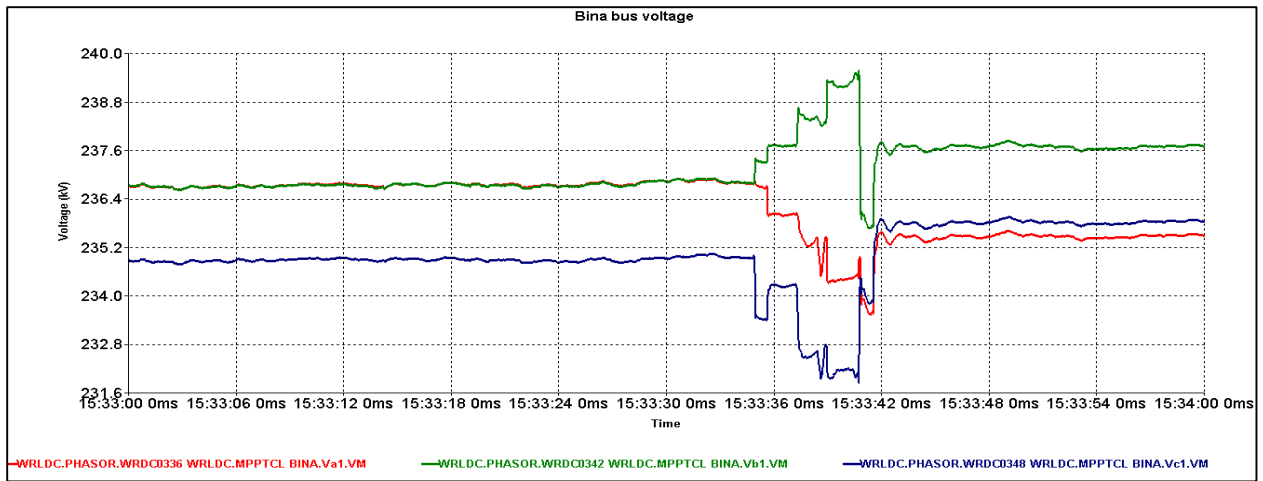


Figure 8 : 400 kV Bina (MP) Bus 1 voltage from PMU.

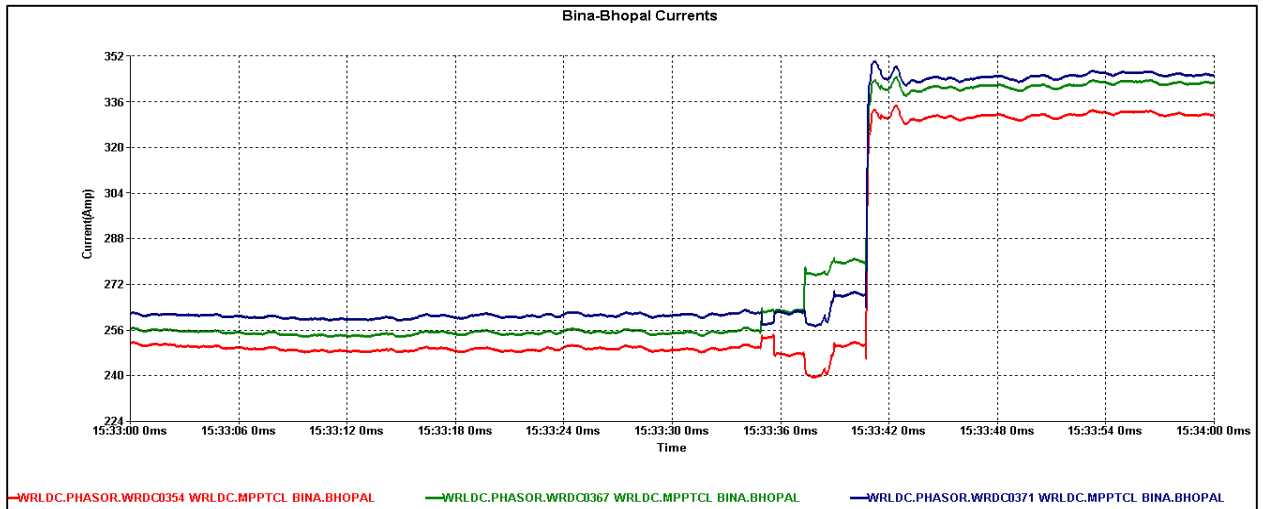


Figure 9 : 400 kV Bina (MP) –Bhopal 1 current from PMU.

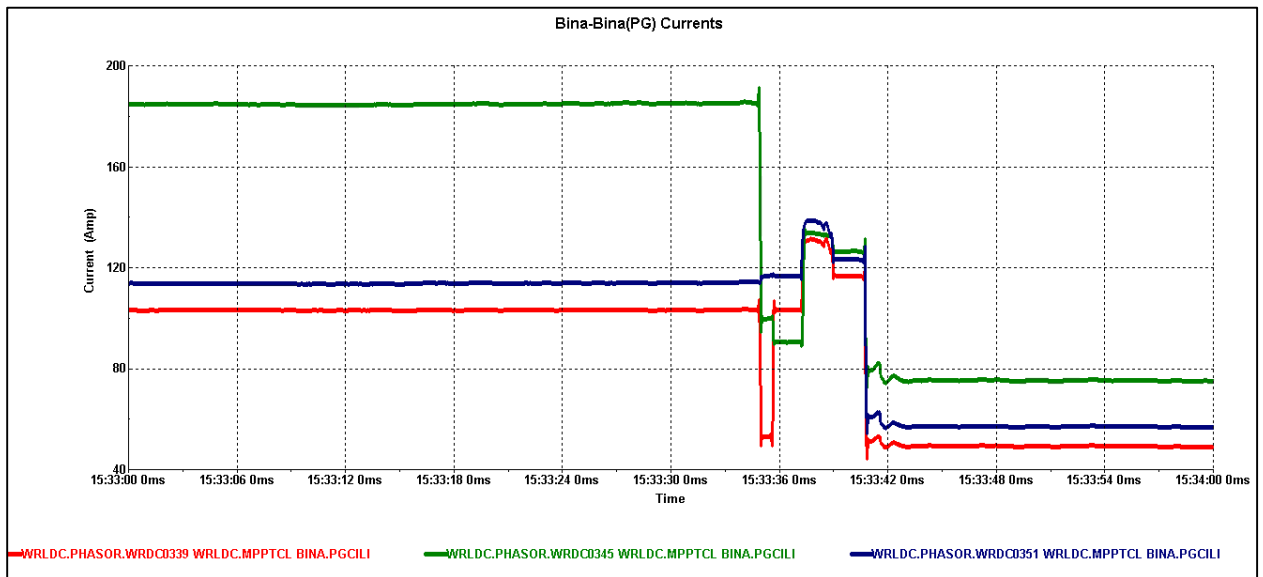


Figure 10 : 400 kV Bina (MP) –Bina (PG) 1 current from PMU.

7. Remarks:

- As the issue has emerged due to impartial closing of one of the phases causing imbalance in load and impedance, so healthiness of all the isolators may be checked at Bina (MP) Sub-station.
- It was informed by Madhya Pradesh SLDC that the operation was done without any intimation to them. This is highly undesirable in view of the integrated operation of the grid. It is advised to do all such operational exercise keeping MP SLDC/WRLDC involved. Such operation are violation of IEGC 5.2. b, c, d which may kindly be complied all the time as per the regulatory provision

Annexure: Report from MP SLDC

Pre-Fault Condition

On dated 15.01.2016 at around 15:33 Hrs MP System was normal and frequency of National Grid was 50.09 Hz.

At 400 kV S/s Bina, one-and-half breaker scheme exists at 400 kV & Double Main Transfer Bus Scheme exists for 220 kV system. 220 kV Bina – Gwalior Ckt – I & II were kept open from 15/10/2015 at 18:25 Hrs. (due to the failure of 400/220 kV, 315 MVA ICT – I at 400 kV S/s Bina, to avoid overloading of remaining two X'mers) and 220 kV Bina – Sagar Ckt – I & II were opened on 15.01.2016 at 09:46 Hrs. from 400 kV S/s Bina end to restrict/avoid the over loading of 400/220 kV, ICT – I & II at 400 kV S/s Bina. Remaining all 220 kV & 400 kV feeders were in charged condition. 400 kV & 220 kV Bus Bar Protection was in service at 400 kV S/s Bina.

Further 220 kV Bina – Vidisha Ckt & 220 kV Bina – Ganjbasoda Ckt were also kept open from 16:18 Hrs. on 04.12.2015 from 220 kV S/s Bina end and 132 kV Bina – Sagar Ckt, 132 kV Bina – Ganjbasoda Ckt, 132 kV Sironj – Ganjbasoda Ckt, 132 kV Sironj – Maqsdangarh Ckt, 132 kV Bina – Chanderi Ckt and 132 kV Bhonra – Raghogarh Ckt were also kept open for load management. Consequently complete load of 220 kV S/s Bina & 220 kV S/s Guna was fed through 400 kV S/s Bina.

Prior to fault feeder arrangement and loading of 220 kV feeders & 400/220 kV transformers at 400 kV S/s Bina were as follows:-

| 220 kV MAIN BUS – I | | | 220 kV MAIN BUS – II | | |
|---------------------|----------------------------------|---------------|----------------------|-----------------------------------|---------------|
| S.No | Name of Feeders/X'mers | Loading in MW | S.No | Name of Feeders/X'mers | Loading in MW |
| 1. | 220 kV Bina (MP) – Guna Ckt – II | 110 | 1. | 220 kV Bina (MP) – Guna Ckt – I | 108 |
| 2. | 220 kV Bina (MP) – Bina – I | 112 | 2. | 220 kV Bina (MP) – Bina – II | 121 |
| 3. | 400/220 kV, 315 MVA ICT – III | -225 | 3. | 400/220 kV, 315 MVA ICT – II | -245 |
| 4. | 220 kV Bina – Sagar Ckt – I | OFF | 4. | 220 kV Bina – Sagar Ckt – II | OFF |
| 5. | 220 kV Bina – Gwalior Ckt – I | OFF | 5. | 220 kV Bina – Gwalior Ckt – II | OFF |
| | | | 6. | 220 kV Bina(MP) – Shivpur Ckt | 109 |
| | | | 7. | 220 kV Bina(MP) – Bina(PGCIL) Ckt | -108 |

Occurrence

At 400 kV S/s Bina, new 400/220 kV, 315 MVA ICT – II was connected recently on 04.01.2016 and due to the difference in % impedance of 400/220 kV, 315 MVA ICT – II & III the load was not equally shared by both the ICT's hence to balance the loading of both 220 kV Main Buses at 400 kV S/s Bina, at around 15:33 Hrs., during Bus exchange operation of 400/220 kV, 315 MVA ICT – III from 220 kV Main Bus – I to 220 kV Main Bus – II at 400 kV S/s Bina(M.P), 220 kV Main Bus – II side isolator of 400/220 kV, 315 MVA ICT – III caused current mismatch/load impedance in phases resulting in tripping of following feeders & transformers on E/F indication:-

| S.No. | Name of Feeder/transformer | Tripping End | Tripping Time | Indication |
|-------|--|------------------------|---------------|---|
| 1. | 400/220 kV, 315 MVA ICT – III | 400 kV S/s Bina | 15:33 Hrs. | E/F |
| 2. | 400/220 kV, 315 MVA ICT – II | 400 kV S/s Bina | 15:33 Hrs. | E/F |
| 3. | 220 kV Bus Tie | 400 kV S/s Bina | 15:33 Hrs. | E/F |
| 4. | 220 kV Bina (MP) – Bina (PGCIL) Ckt | Both End | 15:33 Hrs. | 400 kV Bina (MP) end:- Master trip, DT Received. |
| | | | | 400 kV Bina (PGCIL) end:- DEF opt., DT Send. |
| 5. | 220 kV Bina – Bina Interconnector – I | 220 kV S/s Bina end | 15:33 Hrs. | 220 kV S/s Bina end:- C/B L/O, 186A, 186B. |
| 6. | 220 kV Bina – Shivpuri Ckt. | 220 kV S/s Shivpuri | 15:33 Hrs. | 220 kV S/s Shivpuri end:- DPR Optd., trip Phase-ABC, Z-III |

Due to the tripping interruption occurred in following areas:-

1. 400 kV S/s Bina.
2. 220 kV S/s Bina.
3. 220 kV S/s Guna.
4. 132 kV S/s Sironj.
5. 132 kV S/s Khurai.
6. 132 kV S/s Ashoknagar.
7. 132 kV S/s Aron.
8. 132 kV GAIL.
9. 132 kV S/s Bhonra.
10. 132 kV BORL – I & II (*Industrial Feeder*).
11. 132 kV Railway Traction – I & II at 220 kV S/s Bina.
12. 132 kV Bina Mungaoli Railway Traction.

Remedial Measures

132 kV Supply at 220 kV S/s Bina was resumed by charging 132 kV Bina – Chanderi Ckt at 15:59 Hrs. on 15.01.2016. consequently following feeders and transformers were charged:-

| S.No. | NAME OF FEEDERS/TRANSFORMERS | TIME | |
|-------|---|--------------------|--------------------|
| | | TRIPPING (in Hrs.) | CHARGING (in Hrs.) |
| 1. | 132 kV Bina Railway Traction – I & II at 220 kV S/s Bina. | 15:33 | 15:59 |
| 2. | 132 kV Bina Railway Traction at 220 kV S/s Bina. | 15:33 | 15:59 |

220 kV supply at 400 kV S/s Bina was resumed by charging 400/220 kV, 315 MVA ICT – II at 16:05Hrs. and 220 kV Main Bus – II was charged at 400 kV S/s Bina. Thereafter following feeders and transformers were charged:-

| S.No. | NAME OF FEEDERS/TRANSFORMERS | TIME | |
|-------|--|--------------------|--------------------|
| | | TRIPPING (in Hrs.) | CHARGING (in Hrs.) |
| 1. | 220 kV Bina – Bina Interconnector – II | 15:33 | 16:10 |
| 2. | 220/132 kV, 160 MVA TELK X'mer at 220 kV S/s Bina. | 15:33 | 16:10 |
| 3. | 220 kV Bina – BORL Ckt – I & II (<i>Industrial feeder</i>) | 15:33 | 16:12 |
| 4. | 220/132 kV, 3X40 MVA BHEL X'mer at 220 kV S/s Bina | 15:33 | 16:14 |
| 5. | 132 kV Bina – Khurai Ckt | 15:33 | 16:14 |
| 6. | 220 kV Bina – Bina Interconnector – I | 15:33 | 16:15 |
| 7. | 220 kV Bina – Ashok Nagar Ckt | 15:33 | 16:18 |
| 8. | 132/33 kV, 40 MVA X'mer – I at 220 kV S/s Bina. | 15:33 | 16:18 |
| 9. | 132/33 kV, 40 MVA X'mer – II at 220 kV S/s Bina. | 15:33 | 16:29 |
| 10. | 132/33 kV, 40 MVA X'mer – III at 220 kV S/s Bina. | 15:33 | 16:30 |
| 11. | 220 kV Bina – Guna Ckt – II | 15:33 | 16:50 |
| 12. | 132 kV Bina – Sironj Ckt | 15:33 | 16:52 |
| 13. | 132 kV Bina – Rajghat Ckt | 15:33 | 16:56 |
| 14. | 220 kV Bina(MP) – Bina(PGCIL) Ckt | 15:33 | 17:05 |
| 15. | 400/220 kV, 315 MVA ICT – III | 15:33 | 17:25 |
| 16. | 220 kV Bina – Sagar Ckt – I | OFF | 17:35 |
| 17. | 220 kV Bina – Sagar Ckt – II | OFF | 17:35 |
| 18. | 220 kV Bina – Guna Ckt – II | 15:33 | 17:35 |
| 19. | 220 kV Bina – Shivpuri Ckt | 15:33 | 17:45 |

The relay indications appeared in various transmission elements provided by Superintending Engineer (400 kV S/s, Circle), MPPTCL, Bina is enclosed as Annexure – I & IV.

Conclusion

- The above incident occurred during Bus change operation of 400/220 kV, 315 MVA ICT – III from 220 kV Main Bus – I to 220 kV Main Bus – II at 400 kV S/s Bina(M.P), 220 kV Main Bus – II side isolator of 400/220 kV, 315 MVA ICT – III caused current mismatch in phases.
- As per IEGC Sub-Regulation (b) of Regulation 5.6.2, it is mandatory for the substation/switchyard officials to obtain the code from SLDC for transmission element outage/charging. But during the

above changeover no intimation/information has been given to SLDC, which falls under the violation of IEGC, hence such practices should be avoided for safe & secure operation of Grid.

Load Loss

Total Load Loss was approx. 475 MW, 315 MWH and duration of outage was approx. 40 Minutes.

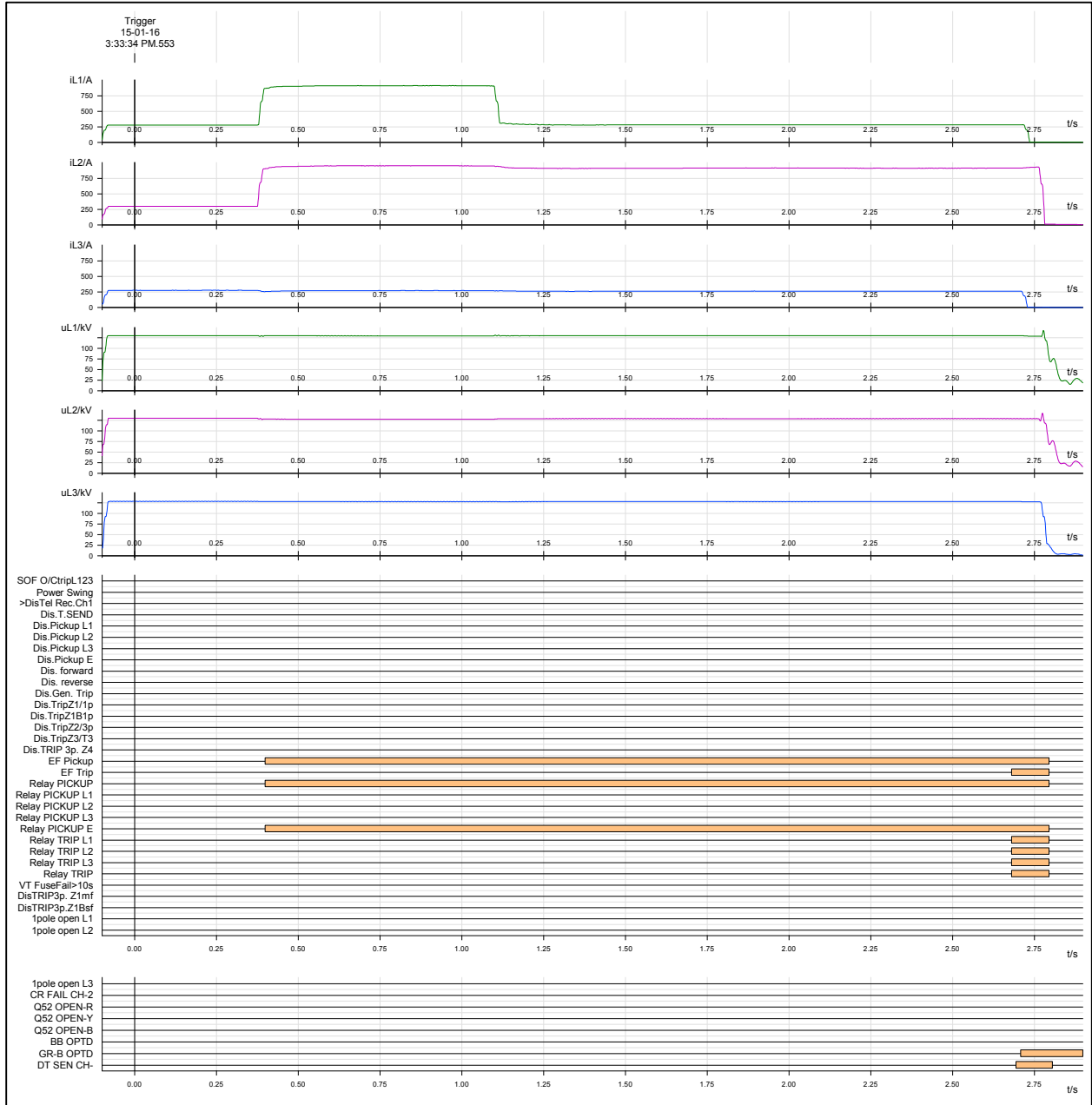


Fig: 220 kV Bina-Bina (PG) DR file from Bina(PG) end indicating the unbalance in system causing neutral current and E/F operation.

Annexure 1: Report from MP SLDC for event 1**Pre-Fault Condition**

On dated 12.02.2016 at around 18:50 Hrs. MP System was normal and frequency of National Grid was 50.04 Hz. 220 kV Rewa – Tons Ckt – I & II, 132 kV Rampur Bhagalen – Rewa Ckt, 132 kV Amarpatan – Jhinna Ckt was kept open for load management, hence complete load of Rewa and Sidhi region was fed through 220 kV Amarkantak – Sidhi Ckt and 220 kV Birsinghpur (SGTPS) – Rewa Ckt. Remaining all 220 kV & 132 kV feeders at 220 kV S/s Rewa & 220 kV S/s Sidhi was in charged condition and normally loaded.

Occurrence

At 18:58 Hrs. on 12.02.2016, 33 kV, 'R' & 'Y'- Phase pole of CB of 132/33 kV, 20 MVA GEC X'mer burst at 220 kV S/s Sidhi, resulting in 33 kV Bus Fault and tripping of 132/33 kV, 40 MVA BHEL X'mer. But there was delayed fault clearance by 132/33 kV, 20 MVA X'mer from 132 kV side as its Master Trip relay (*Avana Make*) did not operate, consequently fault was fed through 220/132 kV, 160 MVA X'mer and caused current unbalancing in 220/132 kV, 160 MVA X'mer at 132 kV side resulting in tripping of 132 kV incomer of 220/132 kV, 160 MVA X'mer at 220 kV S/s Sidhi. Due to above tripping following feeders and X'mers tripped:-

| S.No | Name of Feeder/transformer | Tripping End | Tripping Time | Indication |
|------|---------------------------------------|-------------------|---------------|--|
| 1. | 132/33 kV, 20 MVA GEC X'mer | 220 kV S/s Sidhi. | 18:58 | 33 kV 'R' & 'Y'- Phase pole of CB Burst. Delayed Fault clearance by Master Trip Relay. |
| 2. | 132/33 kV, 40 MVA BHEL X'mer | 220 kV S/s Sidhi. | 18:58 | 33 kV Bus Fault |
| 3. | 220/132 kV, 160 MVA BHEL X'mer | 220 kV S/s Sidhi. | 18:58 | 132 kV incomer tripped due to current unbalancing. |
| 4. | 132 kV Sidhi – Rewa II (Pahariya) Ckt | 220 kV S/s Sidhi. | 18:58 | O/C, E/F, Back-up relay & Master Trip relay operated. |
| 5. | 132 kV Rewa - Mangawan Ckt | Both end. | 18:58 | <u>220 kV S/s Rewa End:-</u> DPR operate, 'R'- Phase, Zone-I, Dist-78.57 Km. <u>132 kV S/s Mangawan end:-</u> O/C/E/F Back-up relay operated. |

Due to the above tripping interruption occurred at following Sub-stations:-

1. 132 kV Supply at 220 kV S/s Sidhi.
2. 132 kV S/s Sidhi.

3. 132 kV S/s Deosar.
4. 132 kV S/s Mauganj.
5. 132 kV S/s Katra.
6. 132 kV S/s Mangawan.

The relay indications appeared in various transmission elements provided by the Addl. Superintending Engineer (T&C), MPPTCL, Rewa is enclosed as annexure – I & II.

Remedial Measures

132 kV Supply at 220 kV S/s Sidhi was resumed by charging 220/132 kV, 160 MVA incomer at 220 kV S/s Sidhi at 19:10 Hrs. Subsequently following feeders and transformers were charged:-

| S.No. | Name Of Feeder/Transformer | Time in Hrs. | |
|-------|--|--------------|----------------------|
| | | Tripping | Charging |
| 1. | 132 kV Rewa – Mangawan Ckt | 18:58 | 19:12 |
| 2. | 132 kV Mangawan – Katra Ckt | 18:58 | 19:12 |
| 3. | 132 kV Katra – Mauganj Ckt | 18:58 | 19:12 |
| 4. | 132/33 kV, 40 MVA BHEL X'mer at 220 kV S/s Sidhi | 18:58 | 19:15 |
| 5. | 132 kV Sidhi Interconnector - I | 18:58 | 19:23 |
| 6. | 132 kV Sidhi Interconnector - I | 18:58 | 19:23 |
| 7. | 132 kV Sidhi – Deosar Ckt - I | 18:58 | 19:30 |
| 8. | 132 kV Sidhi – Deosar Ckt - II | 18:58 | 19:30 |
| 9. | 132 kV Sidhi – Mauganj Ckt | 18:58 | 19:36 |
| 10. | 132 kV Sidhi – Rewa II (Pahariya) | 18:58 | 19:45 |
| 11. | 132/33 kV, 20 MVA X'mer at 220 kV S/s Sidhi | 18:58 | 14:13 on 16.02.16 |

Conclusion

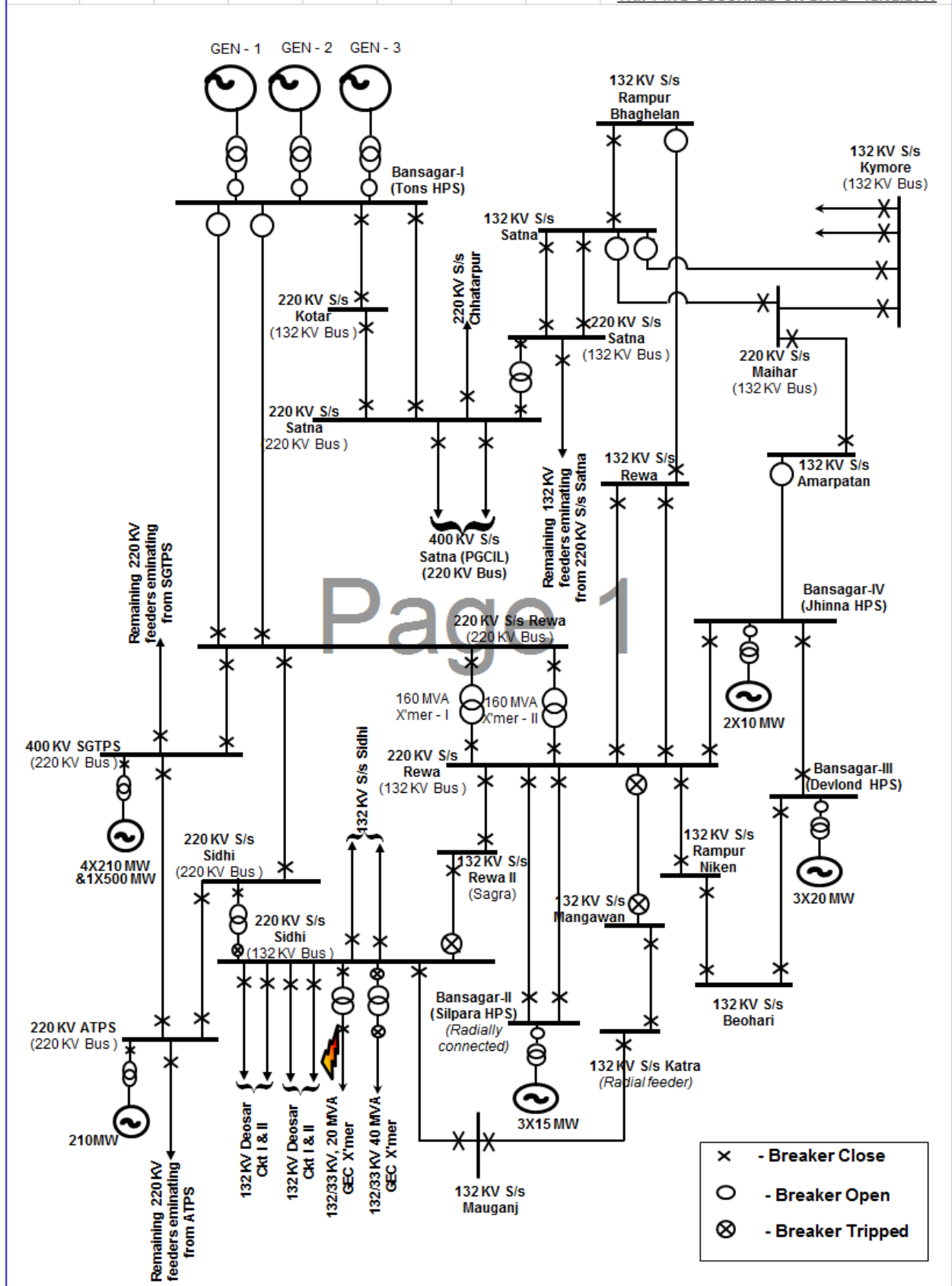
- The tripping occurred 33 kV, 'R' & 'Y'- Phase pole of CB of 132/33 kV, 20 MVA GEC X'mer burst at 220 kV S/s Sidhi and delayed clearance of fault by 132 kV side Master Trip relay (*Avana Make*) of 132/33 kV, 20 MVA GEC X'mer at 220 kV S/s Sidhi.
- The 132 kV faulty Master Trip Realty and burst 33 kV, 'R' & 'Y'- Phase pole of CB of 132/33 kV, 20 MVA GEC X'mer has been replaced and X'mer charged at 14:13 Hrs. on 16.02.2016.

Generation Loss: - Nil.

Load Loss: Total Load Loss was approx. **172.97MW, 74MWH** and duration of outage was approx. 1Hour 30 Minutes.

SINGLE LINE DIAGRAM OF 220 KV Sidhi S/s

TRIPPING OCCURRED ON DATE - 12.02.2016



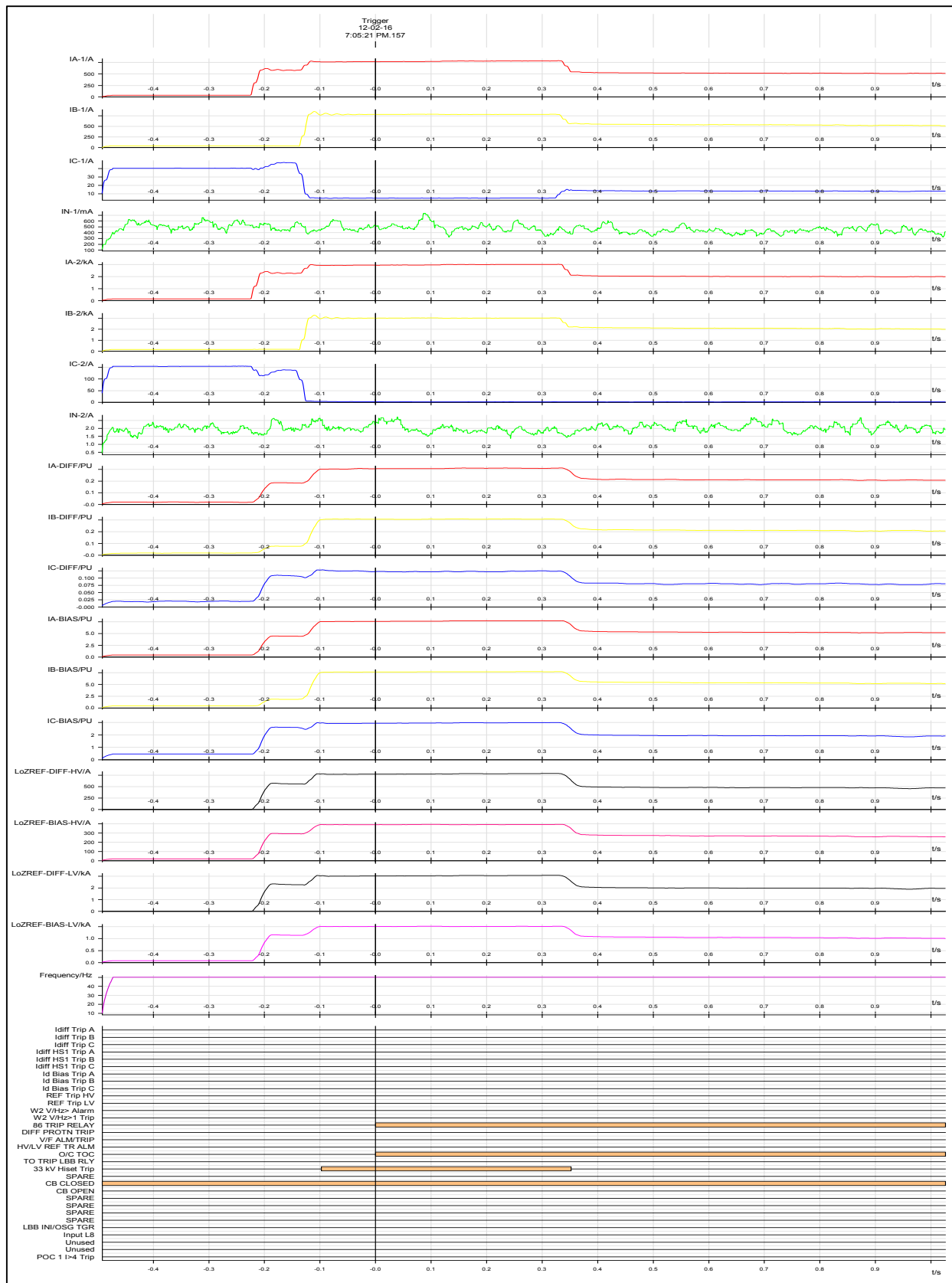


Figure: DR of 132/33 kV 20 MVA ICT 1 indicating delayed fault clearance

Annexure 2 : Report from MP SLDC for Event 2 and 3

Pre-Fault Condition

On dated 12.02.2016 at around 22:10 Hrs. M.P System was normal and frequency of National Grid was 49.99 Hz. 220 kV Rewa – Tons Ckt – I Tap Sirmour Ckt (*tapping arrangement is temporary, 220 kV Rewa – Tons Ckt – I will be LILO at 220 Sirmour, LILO work is under process*) was opened from Tons HPS end for load management hence 220 kV New S/s Sirmour was being fed through 220 kV S/s Rewa. Also, 220 kV Rewa – Tons Ckt – II, 132 kV Rampur Bhagalen – Rewa Ckt, 132 kV Amarpatan – Jhinna Ckt was kept open for load management, hence complete load of Rewa and Sidhi region was fed through 220 kV Amarkantak – Sidhi Ckt and 220 kV Birsinghpur (SGTPS) – Rewa Ckt. 132/33 kV, 20 MVA GEC X'mer at 220 kV S/s Sidhi was out of service as due to failure of its R & Y-Phase CB since 12.02.2016. Remaining all 220 kV & 132 kV feeders at 220 kV S/s Rewa & 220 kV S/s Sidhi was in charged condition and normally loaded.

Loading of 220 kV Feeders prior to fault:-

| S.No. | Name of Feeders/X'mers | Loading in MW |
|-------|--|--|
| 1. | 220 kV Amarkantak – Sidhi Ckt. | 162 |
| 2. | 220 kV Birsinghpur (SGTPS) – Sidhi Ckt | 169 |
| 3. | 220 kV Rewa – Sidhi Ckt | 17.4 |
| 4. | 22 kV Sidhi – Hindalco Ckt | 23.20 (export from 220 kV S/s Sidhi). |

Occurrence

At 22:12 Hrs. on 12.02.2016, 220 kV Amarkantak – Sidhi Ckt tripped on transient fault from both end (*indications enclosed as Annexure – III*). Consequently complete load of 220 kV S/s Rewa & 220 kV Sidhi shifted on 220 kV Birsinghpur (SGTPS) – Rewa Ckt resulting in over loading and tripping of 220 kV Birsinghpur (SGTPS) – Rewa Ckt (*indications enclosed as Annexure – II*). Due to the above tripping interruption occurred in following areas due to non-availability of any other source:-

1. 220 kV S/s Rewa.
2. 220 kV S/s Sidhi.
3. 220 kV S/s Sirmour.
4. 132 kV S/s Rewa.
5. 132 kV S/s Sidhi.
6. 132 kV S/s Deosar.
7. 132 kV S/s Mauganj.

8. 132 kV S/s Katra.
9. 132 kV S/s Mangawan.
10. 132 kV S/s Rewa II (Sagra/Paharia).
11. 132 kV S/s Rampur Niken.
12. 132 kV Beohari.
13. Jhinna HPS.
14. Silpara HPS.
15. Devlond HPS.
16. 220 kV Hindalco (Industry).

While resuming the system there was delay in resuming the supply at 220 kV S/s Rewa as there was problem in resetting the relays at Rewa. After resuming the supply at 220 kV S/s Rewa by charging 220 kV Rewa – Sidhi Ckt, thereafter 220 kV Birsinghpur (SGTPS) – Rewa Ckt was charged from 220 kV S/s Rewa end but was not able to synchronized from Birsinghpur (SGTPS) due to High Voltage, hence complete load of 220 kV S/s Rewa & 220 kV S/s Sidhi was fed through 220 kV Amarkantak – Sidhi Ckt.

At around **00:23 Hrs. on 13.03.2016**, 220 kV Amarkantak – Sidhi Ckt again tripped from both on transient fault (*indications enclosed as Annexure – III*). Consequently interruption again occurred at above mentioned 15 Nos. Sub-stations.

The relay indications appeared in various transmission elements provided by the Addl. Superintending Engineer (T&C), MPPTCL, Rewa is enclosed as annexure – I & II.

Restoration

132 kV supply at kV S/s Rewa was resumed by 132 kV Rewa – Rampur Bhagelan Ckt at 22:42 Hrs. and there after 132 kV Bus at 220 kV S/s Rewa was charged at 22:42 Hrs. by charging 132 kV Rewa Interconnector – II. 220 kV Supply at 220 kV S/s Sidhi was resumed by charging 220 kV Amarkantak – Sidhi Ckt. at 22:51 Hrs. Subsequently following feeders and transformers were charged:-

| S.No. | Name Of Feeder/Transformer | Time in Hrs. | |
|-------|--|-----------------------|-----------------------|
| | | Tripping (in Hrs.) | Charging (in Hrs.) |
| 1. | 220/132 kV, 160 MVA BHEL X'mer at 220 kV S/s Sidhi | 22:12 | 22:57 |
| 2. | 132/33 kV, 40 MVA BHEL X'mer at 220 kV S/s Sidhi | 22:12 | 23:00 |
| 3. | 132/33 kV, 40 MVA EMCO X'mer at 220 kV S/s Rewa | 22:12 | 23:00 |
| 4. | 220 kV Sidhi Interconnector – I | 22:12 | 23:03 |
| 5. | 132 kV Sidhi Interconnector - II | 22:12 | 23:04 |

| | | | |
|-----|---|-------|-------|
| 6. | 132 kV Sidhi – Deosar Ckt - I | 22:12 | 23:08 |
| 7. | 132 kV Sidhi – Deosar Ckt - II | 22:12 | 23:08 |
| 8. | 220 kV Rewa – Sidhi Ckt | 22:12 | 23:10 |
| 9. | 132 kV Sidhi – Mauganj Ckt | 22:12 | 23:13 |
| 10. | 220 kV Sidhi – Hindalco (Radial Feeder) | 22:12 | 23:16 |
| 11. | 132 kV Sidhi – Rewa II (Pahariya) | 22:12 | 23:17 |
| 12. | 220/132 kV, 160 MVA BHEL X’mer at 220 kV S/s Rewa | 22:12 | 23:30 |
| 13. | 132 kV Rewa – Silpara – I & II | 22:12 | 23:38 |
| 14. | 132 kV Rewa – Rewa II (Pahariya) Ckt. | 22:12 | 23:39 |
| 15. | 132 kV Rewa Interconnector – I | 22:12 | 23:41 |
| 16. | 132/33 kV, 40 MVA NGEF X’mer at 220 kV S/s Rewa | 22:12 | 23:43 |
| 17. | 132 kV Rewa – Rampur Naikin Ckt | 22:12 | 23:49 |
| 18. | 132 kV Rewa – Beohari Ckt | 22:12 | 23:49 |
| | 220/132 kV, 160 MVA CGL X’mer at 220 kV S/s Rewa | 22:12 | 00:04 |
| | 132 kV Rewa – Jhinna Ckt | 22:12 | 00:07 |

At 220 kV S/s Rewa, after taking supply from 220 kV S/s Sidhi and normalizing the system, 132 kV Rewa – Rampur Bhagalen was opened 23:55 Hrs. on 05.03.2016.

After the second incident (*i.e., after tripping of 220 kV Amarkantak – Sidhi Ckt at 00:23 Hrs. on 13.02.2016*) the supply at 220 kV S/s Sidhi was resumed by charging 220 kV Amarkantak – Sidhi Ckt at 00:34 Hrs. Subsequently following feeders were charged:-

| S.No. | Name Of Feeder/Transformer | Time in Hrs. | |
|-------|--|-----------------------|-----------------------|
| | | Tripping (in Hrs.) | Charging (in Hrs.) |
| 1. | 220 kV Rewa – Tons Ckt – II | 00:23 | 00:34 |
| 2. | 220/132 kV, 160 MVA BHEL X’mer at 220 kV S/s Sidhi | 00:23 | 00:35 |
| 3. | 132/33 kV, 40 MVA BHEL X’mer at 220 kV S/s Sidhi | 00:23 | 00:37 |
| 4. | 132 kV Sidhi – Deosar Ckt - I | 00:23 | 00:38 |
| 5. | 132 kV Sidhi – Deosar Ckt - II | 00:23 | 00:38 |
| 6. | 132 kV Sidhi – Mauganj Ckt | 00:23 | 00:39 |
| 7. | 220/132 kV, 160 MVA BHEL X’mer at 220 kV S/s Rewa | 00:23 | 00:39 |
| 8. | 220 kV Sidhi Interconnector – I | 00:23 | 00:40 |

| | | | |
|-----|--|-------|-------|
| 9. | 132 kV Sidhi Interconnector - II | 00:23 | 00:40 |
| 10. | 132/33 kV, 40 MVA EMCO X'mer at 220 kV S/s Rewa | 00:23 | 00:40 |
| 11. | 220/132 kV, 160 MVA CGL X'mer at 220 kV S/s Rewa | 00:23 | 00:42 |
| 12. | 220 kV Sidhi – Hindalco Ckt | 00:23 | 00:43 |
| 13. | 132 kV Sidhi – Rewa II (Pahariya) Ckt | 00:23 | 00:44 |
| 14. | 132 kV Rewa – Silpara Ckt – I & II | 00:23 | 00:44 |
| 15. | 132 kV Rewa – Rampur Naikin Ckt | 00:23 | 00:45 |
| 16. | 132 kV Rewa – Beohri | 00:23 | 00:45 |
| 17. | 132 kV Rewa Interconnector – I & II | 00:23 | 00:46 |
| 18. | 132 kV Rewa – Rewa II (Pahariya) Ckt | 00:23 | 00:46 |
| 19. | 132/33 kV, 40 MVA NGEF X'mer at 220 kV S/s Rewa | 00:23 | 00:47 |
| 20. | 220 kV Rewa – Sidhi Ckt | 00:23 | 01:10 |

Conclusion

- The tripping occurred due to tripping of 220 kV Amarkantak – Sidhi Ckt tripped on transient fault from both end. Consequently complete load of 220 kV S/s Rewa & 220 kV Sidhi shifted on 220 kV Birsinghpur (SGTGS) – Rewa Ckt resulting in over loading and tripping of 220 kV Birsinghpur (SGTGS) – Rewa Ckt.
- DR/EL files has not been provided, event on constant perusal, without which the exact cause of the tripping cannot be investigated. As per Indian Electricity Grid Code, flash report of incidence is to be submitted to WRLDC and WRPC within 24 hours along with DR/EL files in .cfg & .dat formats without which the actual cause of the tripping cannot be investigated.

Generation Loss:- Nil.

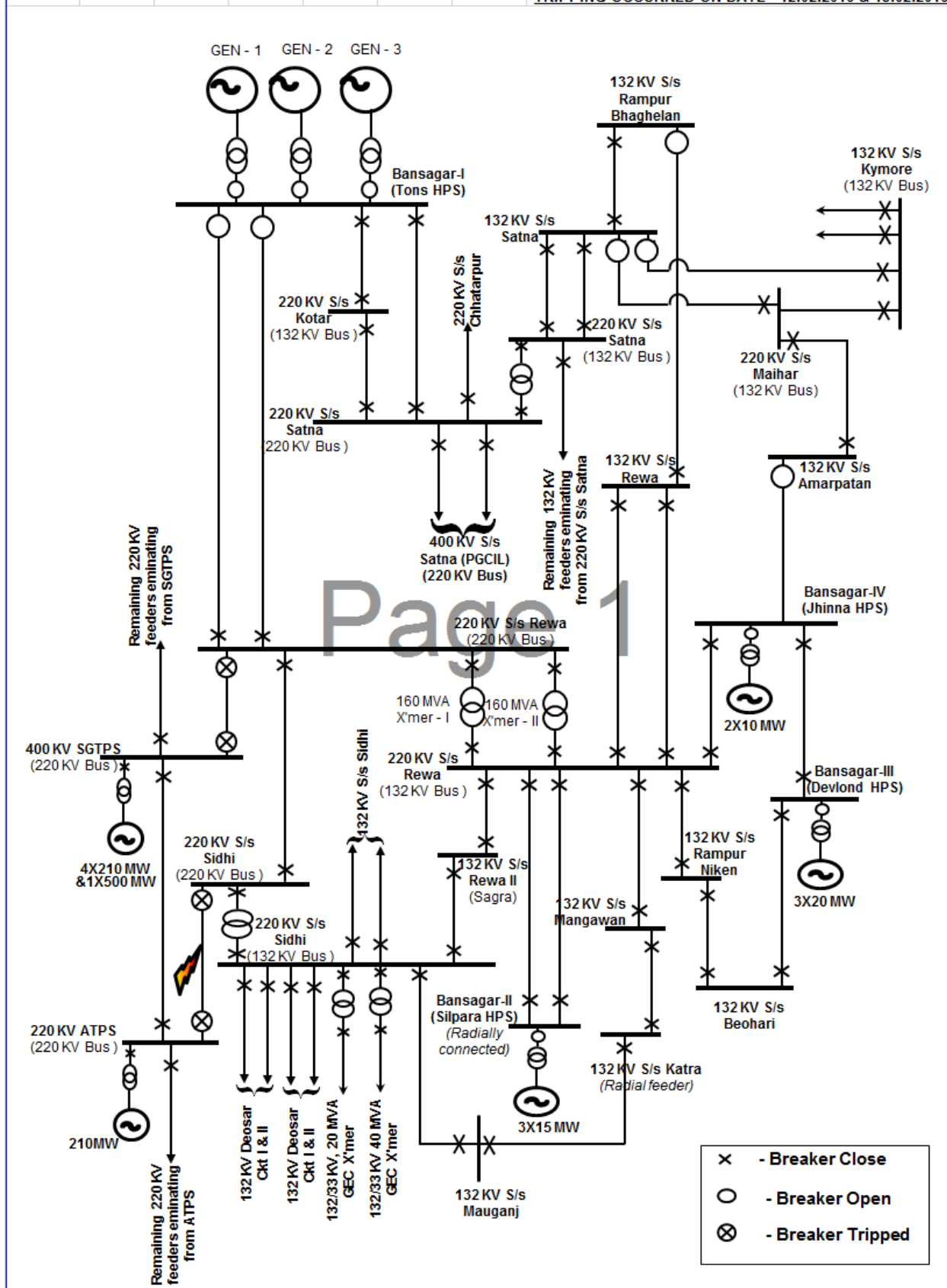
Load Loss

Total Load Loss was approximately as follows:-

1. At 22:12 Hrs. on 12.02.2016 – 301 MW, 301 MWH for about 1 Hour.
2. At 00:23 Hrs. on 13.02.2016 – 326 MW, 162.8 MWH for about 30 min.

SINGLE LINE DIAGRAM OF 220 KV Sidhi S/s

TRIPPING OCCURRED ON DATE - 12.02.2016 & 13.02.2016



Grid Occurrence 220/132 kV Mahalgaon S/s, Madhya Pradesh on 21st February 2016

Event Category: GD-1

Event Date and Time: 21st February 2016, 06:53 Hrs

Event Summary: At 06:53 Hrs, 220 kV Bina – Mahalgaon circuit (which was ideally charged from 220 kV S/s Mahalgaon end) tripped from 220 kV Mahalgaon S/s end on transient fault, resulting in operation of Bus Bar Protection. It is suspected that CT core connected to Bus Bar Protection of 220 kV Bina – Mahalgaon circuit got saturated (as intimated telephonically by Executive Engineer Testing Div. – I, MPPTCL, Gwalior), causing current unbalancing and resulting in operation of 220 kV Bus Bar Protection at 220 kV Mahalgaon S/s. With this all 220 kV elements from Mahalgaon tripped due to single main transfer bus scheme. This led to blackout of Mahalgaon, Datia and nearby connected radial load. The amount of load loss was 302 MW.

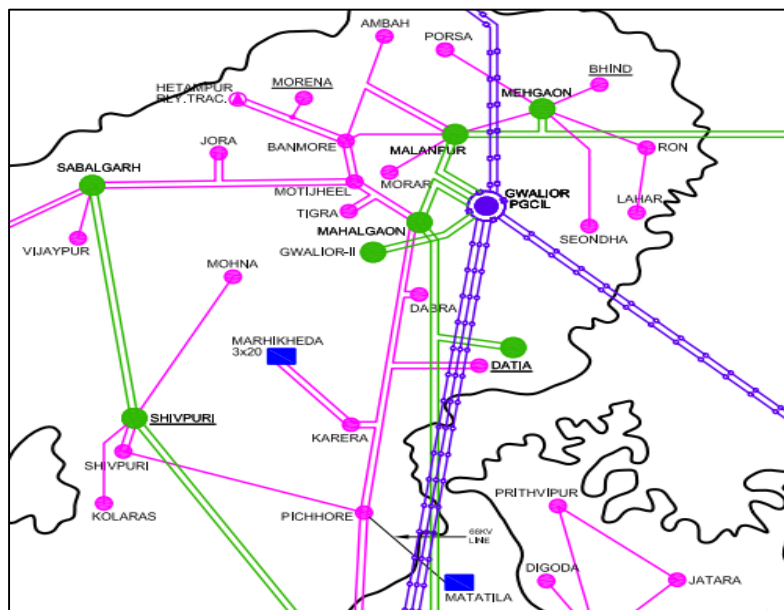


Figure 1 : Geographical Map

Event Overview: The analysis of event is provided in Annexure by MP SLDC. The actual root cause of the event based on the DR of Bus bar protection need to be provided by MPPTCL during the discussion in the next protection forum.

Load/Generation Loss: Load loss during the event due to blackout in Mahalgaon, Datia, Motijheel, Tigra and Jora was around 302 MW and Energy unserved was 22.31 MWhr.

Protection and Operation Related Issues and Recommendation:

- The operation of Bus bar protection at Mahalgaon need to be properly analyzed in detail and suitable measure to be taken in order to improve the reliability of the system.
- Restoration without intimating SLDC/RLDC is violation of IEGC and MP electricity grid code. **MPPTCL may kindly take a look into the matter immediately and report the reason for non-intimation to WRLDC/SLDC.**

Annexure: Report from MP SLDC

Pre-Fault Condition

On dated 21.02.2016 at around 06:50 Hrs. MP System was normal and frequency of National Grid was 49.99 Hz. At 220 kV S/s Mahalgaon (Gwalior) Single Main Transfer Bus system exists. For load management following feeders were open for load management:-

1. 132 kV Motijheel – Banmore Ckt – II.
2. 132 kV Jora – Sabalgarh Ckt.
3. 220 kV Bina – Mahalgaon Ckt.
4. 220 kV Bina – Datia Ckt.

Remaining 220 kV & 132 kV feeders at 220 kV S/s Mahalgaon were in charged condition & normally loaded.

Occurrence

At 06:53 Hrs., 220 kV Bina – Mahalgaon Ckt (*which was ideally charged from 220 kV S/s Mahalgaon end*) tripped from 220 kV S/s Mahalgaon end on transient fault, resulting in operation of Bus Bar Protection. It is suspected that CT core connected to Bus Bar Protection of 220 kV Bina – Mahalgaon Ckt got saturated (*as intimated telephonically by Executive Engineer Testing Div. – I, MPPTCL, Gwalior*), causing current unbalancing and resulting in operation of 220 kV Bus Bar Protection at 220 kV S/s Mahalgaon and tripping of following feeders & transformer:-

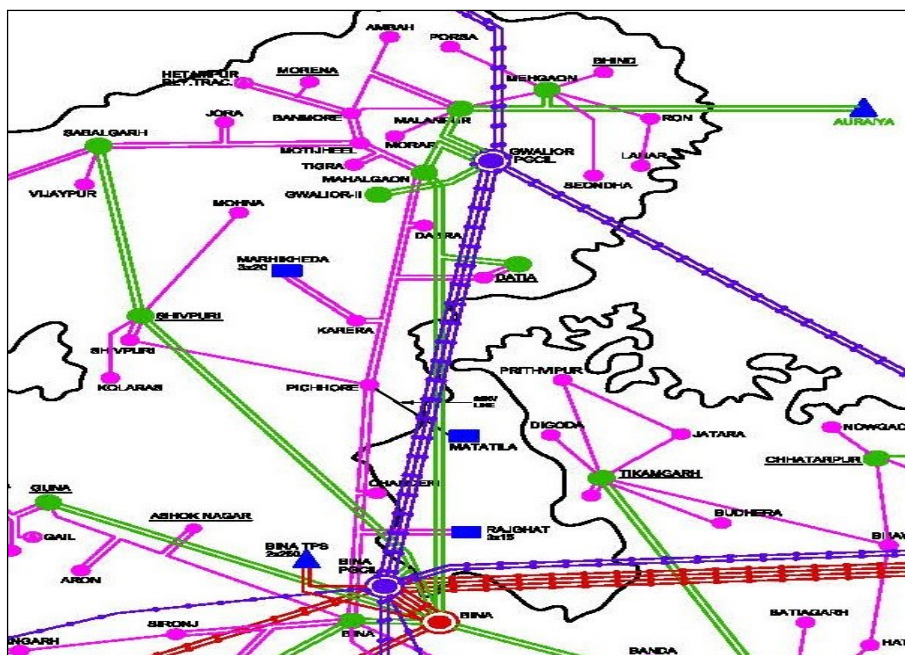
1. 220 kV Mahalgaon – Gwalior (PGCIL) Ckt – I & II.
2. 220 kV Mahalgaon – Datia Ckt.
3. 220/132 kV, 160 MVA X'mer – I & II at 220 kV S/s Mahalgaon.
4. 220/132 kV, 3X40 MVA X'mer – III at 220 kV S/s Mahalgaon.

Due to the tripping of above feeders complete load of 220 kV Mahalgaon & 220 kV S/s Dabra shifted on 132 kV Motijheel – Banmore Ckt – II, 132 kV Karera – Mahalgaon Ckt & 132 kV Dabra – Mahalgaon Ckt resulting in tripping of these circuits on over loading from 132 kV Karera & 132 kV Dabra end respectively.

Due to the above tripping interruption occurred at following sub-stations:-

1. 220 kV S/s Mahalgaon.
2. 220 kV S/s Datia.
3. 132 kV S/s Motijheel.
4. 132 kV S/s Tigra.
5. 132 kV S/s Jora.
6. 132 kV Railway Traction – I & II at 220 kV S/s Mahalgaon.

Schematic Diagram of area of MP where tripping occurred is as under:-



Restoration:-

132 kV supply at 132 kV S/s Motijheel & 132 kV S/s Jora was resumed by charging 132 kV Sabalgarh – Motijheel Ckt & 132 kV Sabalgarh – Jora Ckt respectively at 07:03 Hrs. Thereafter supply was extended to 132 kV S/s Tigra by charging 132 kV Motijheel – Tigra Ckt at 07:03 Hrs.

Supply at 220 kV S/s Mahalgaon was resumed by charging 220 kV Mahalgaon – Gwalior (PGCIL) Ckt – I at 07:04 Hrs. Subsequently following feeders were charged:-

| Sl.No. | Name Of Feeder/Transformer | Time in Hrs. | |
|--------|---|--------------------|--------------------|
| | | Tripping (in Hrs.) | Charging (in Hrs.) |
| 1. | 220 kV Mahalgaon – Gwalior (PGCIL) Ckt – II | 06:55 | 07:04 |
| 2. | 220/132 kV, 160 MVA X’mer – I at 220 kV S/s Mahalgaon. | 06:55 | 07:05 |
| 3. | 220/132 kV, 160 MVA X’mer – II at 220 kV S/s Mahalgaon. | 06:55 | 07:05 |
| 4. | 220/132 kV, 120 MVA X’mer – III at 220 kV S/s Mahalgaon. | 06:55 | 07:05 |
| 5. | 132 kV Railway Traction Ckt – I at 220 kV S/s Mahalgaon. | 06:55 | 07:06 |
| 6. | 132 kV Railway Traction Ckt – II at 220 kV S/s Mahalgaon. | 06:55 | 07:06 |
| 7. | 132 kV Mahalgaon – Karera Ckt. | 06:55 | 07:06 |
| 8. | 132 kV Mahalgaon – Dabra Ckt. | 06:55 | 07:06 |
| 9. | 132/33 kV, 63 MVA X’mer at 220 kV S/s Mahalgaon | 06:55 | 07:06 |

| | | | |
|-----|---|-------|-------|
| 10. | 132/33 kV, 40 MVA X'mer – I at 220 kV S/s Mahalgaon. | 06:55 | 07:06 |
| 11. | 132/33 kV, 40 MVA X'mer – II at 220 kV S/s Mahalgaon. | 06:55 | 07:06 |
| 12. | 132 kV Mahalgaon – Motijheel Ckt | 06:55 | 07:06 |
| 13. | 132 kV Mahalgaon – Tigra Ckt | 06:55 | 07:06 |

Conclusion

- 220 kV Bina – Mahalgaon Ckt (*which was idle charged from 220 kV S/s Mahalgaon end*) tripped from 220 kV S/s Mahalgaon end on transient fault, resulting in operation of Bus Bar Protection.
- It is suspected that CT core connected to Bus Bar Protection of 220 kV Bina – Mahalgaon Ckt got saturated, causing current unbalancing and resulting in operation of 220 kV Bus Bar Protection at 220 kV S/s Mahalgaon.
- System restoration/line charging at 220 kV S/s Mahalgaon was done without obtaining code/intimation to SLDC/WRLDC. Charging/operating of any transmission element without intimation and without obtaining code from the competent authority falls under Grid Code Violation i.e., As per IEGC Sub-Regulation (b) of Regulation 5.6.2 it is mandatory for substation/switchyard officials to obtain the code from SLDC/WRLDC for transmission element outage/charging.
- The instant of such violation should be avoided and compliance of above IEGC Regulation in this regard should be compiled strictly.
- The cause of 220 kV Bus Bar Protection shall be investigated and the CT core of 220 kV Bina – Mahalgaon Ckt at 220 kV S/s Mahalgaon if saturated (*as intimated telephonically by Executive Engineer Testing Div. – I, MPPTCL, Gwalior*), then the CT shall be replaced.

Load Loss

There was load loss of approx. **302 MW, 22.31 MWH** duration of outage was approximately 13 Minutes.

Grid Incidence at 765/400 kV Champa S/s on 27th February 2016

Event Category: GD-1

Event Date and Time: 27th February 2016, 12:52 Hrs

Event Summary: At 12:52 Hrs, it was intimated by PGCIL that due to the inadvertent error while carrying out wiring termination work at adjacent bay during the construction activity, the bus bar trip relay operated causing tripping of 765 kV Bus 1 at Champa S/s and associated connected elements. The elements tripping has occurred as the 765 kV Bus 2 at Champa S/s was already kept out of service without any intimation to WRLDC/NLDC. Due to tripping of all the lines, the substation went dark.

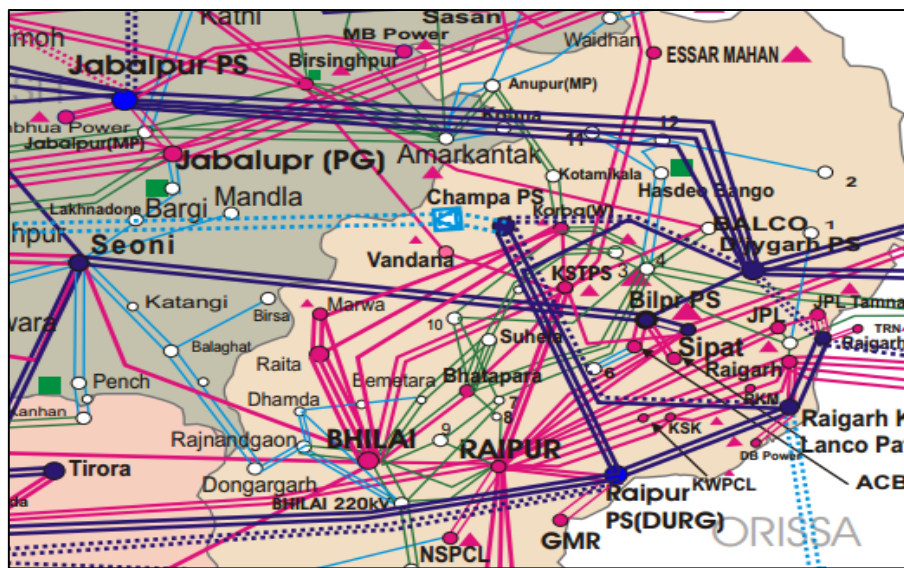


Figure 1 : Geographical Map

Event Analysis: Based on the flash report from WRLDC and Report from PGCIL, it was observed that at 12:52 Hrs, 765 kV Bus 1 has tripped at Champa S/s during construction activity. At the same time 765 kV Champa-Durg and 765 kV Champa-Kotra circuit also tripped. The line tripping was not expected in case of one bus tripping as the same should have remained connected via 765 kV Bus 2. However due to unreliable data from Champa in real time the status of 765 kV bus 2 could not be ascertain in real time. After going through the SOE it is observed that on 1st February at 17:46 Hrs the Bus reactor (yet to come) Main and Tie CB was opened and from this time 765 kV Bus 2 went out of service however same was not intimated. After this it was found that the 765 kV Bus voltage at Champa has become unreliable.

Table 1: SOE of Champa from WRLDC SCADA

| Date and Time | Millisecond | Element | Status |
|-------------------|-------------|-----------------------|--------|
| 01-02-16 17:45:53 | 248 | Champa7 Durg 1 TIE CB | Open |
| 01-02-16 17:46:12 | 885 | Champa7 BR CB | Open |
| 11-02-16 18:44:46 | 635 | Champa4 ICT 2 CB | Closed |
| 11-02-16 18:48:31 | 899 | Champa4 ICT 1 2 TCB | Closed |

| | | | |
|-------------------|-----|---------------------|--------|
| 11-02-16 18:49:39 | 838 | Champa4 ICT 2 CB | Open |
| 12-02-16 12:26:23 | 316 | Champa4 ICT 2 CB | Open |
| 12-02-16 12:57:44 | 330 | Champa4 ICT 1 2 TCB | Open |
| 12-02-16 13:53:20 | 662 | Champa4 ICT 1 CB | Open |
| 12-02-16 14:41:23 | 624 | Champa4 ICT 2 CB | Open |
| 12-02-16 14:41:23 | 624 | Champa4 ICT 2 CB | Open |
| 17-02-16 09:41:23 | 624 | Champa4 ICT 2 CB | Open |
| 17-02-16 09:53:20 | 662 | Champa4 ICT 1 CB | Open |
| 17-02-16 09:57:44 | 330 | Champa4 ICT 1 2 TCB | Open |
| 18-02-16 12:41:23 | 624 | Champa4 ICT 2 CB | Open |
| 18-02-16 12:53:20 | 662 | Champa4 ICT 1 CB | Open |
| 18-02-16 12:57:44 | 330 | Champa4 ICT 1 2 TCB | Open |
| 18-02-16 13:41:23 | 624 | Champa4 ICT 2 CB | Open |
| 18-02-16 13:53:20 | 662 | Champa4 ICT 1 CB | Open |
| 18-02-16 13:57:44 | 330 | Champa4 ICT 1 2 TCB | Open |
| 25-02-16 09:41:23 | 624 | Champa4 ICT 2 CB | Open |
| 25-02-16 09:53:20 | 662 | Champa4 ICT 1 CB | Open |
| 25-02-16 09:57:44 | 330 | Champa4 ICT 1 2 TCB | Open |
| 25-02-16 15:41:23 | 624 | Champa4 ICT 2 CB | Open |
| 25-02-16 15:53:20 | 662 | Champa4 ICT 1 CB | Open |
| 25-02-16 15:57:44 | 330 | Champa4 ICT 1 2 TCB | Open |
| 27-02-16 12:50:16 | 984 | Champa7 Durg 2 CB | Open |
| 27-02-16 12:50:16 | 982 | Champa7 Durg 1 CB | Open |
| 27-02-16 14:36:05 | 744 | Champa7 Durg 1 CB | Closed |
| 27-02-16 14:37:44 | 670 | Champa7 Durg 2 CB | Closed |
| 27-02-16 15:25:09 | 821 | Champa7 BR CB | Closed |

The reason for the 765 kV Bus 1 tripping is also not found reasonable in the submitted report and it's mentioned as inadvertent error during construction work. However on clarification on the above issue PGCIL has not yet submitted any further details to WRLDC. The submitted report from PGCIL and DR files is attached as annexure.

Remarks and Recommendation:

- It was observed that 765 kV Bus 2 at Champa S/s was kept out for quite a duration without intimation and was not taken back in service thereafter. Such outage are not desirable and it also is not in line with the IEGC. So, sub-station may be advised to provide complete information to WRLDC while taking any outage (Planned/Emergency) along with the code.
- The non-submission of information in regard to the queries raised by WRLDC on the misoperation of Bus bar protection and outage of 765 kV Bus 2 has not been provided even after one and half month duration which is not desirable related to the coordinated effort of grid operation by WRLDC. So utility may kindly submit the details and root cause analysis.
- As the Champa will be a major sub-station in future with its connectivity with 2 x3000 MW ±800 kV Champa-Kurikshetra HVDC, such outage are not desirable and Utility is requested to coordinate for any outage required with WRLDC.

**Report on Bus Bar Trip Relay Operation at 765/400kV PS on 27
Feb'16 at 12.50Hrs.**

Cause of Fault: Inadvertent error while carrying out wiring termination work at adjacent bay for which construction work is under progress.

Station Status before and after tripping:

Before Tripping: The following elements were in service,

1. 765kV Bus-I
2. 765kV Champa-Durg S/C through 70152 CB.
3. 765kV Champa-Kotra S/C through 70452 CB.

The following elements were in out of service,

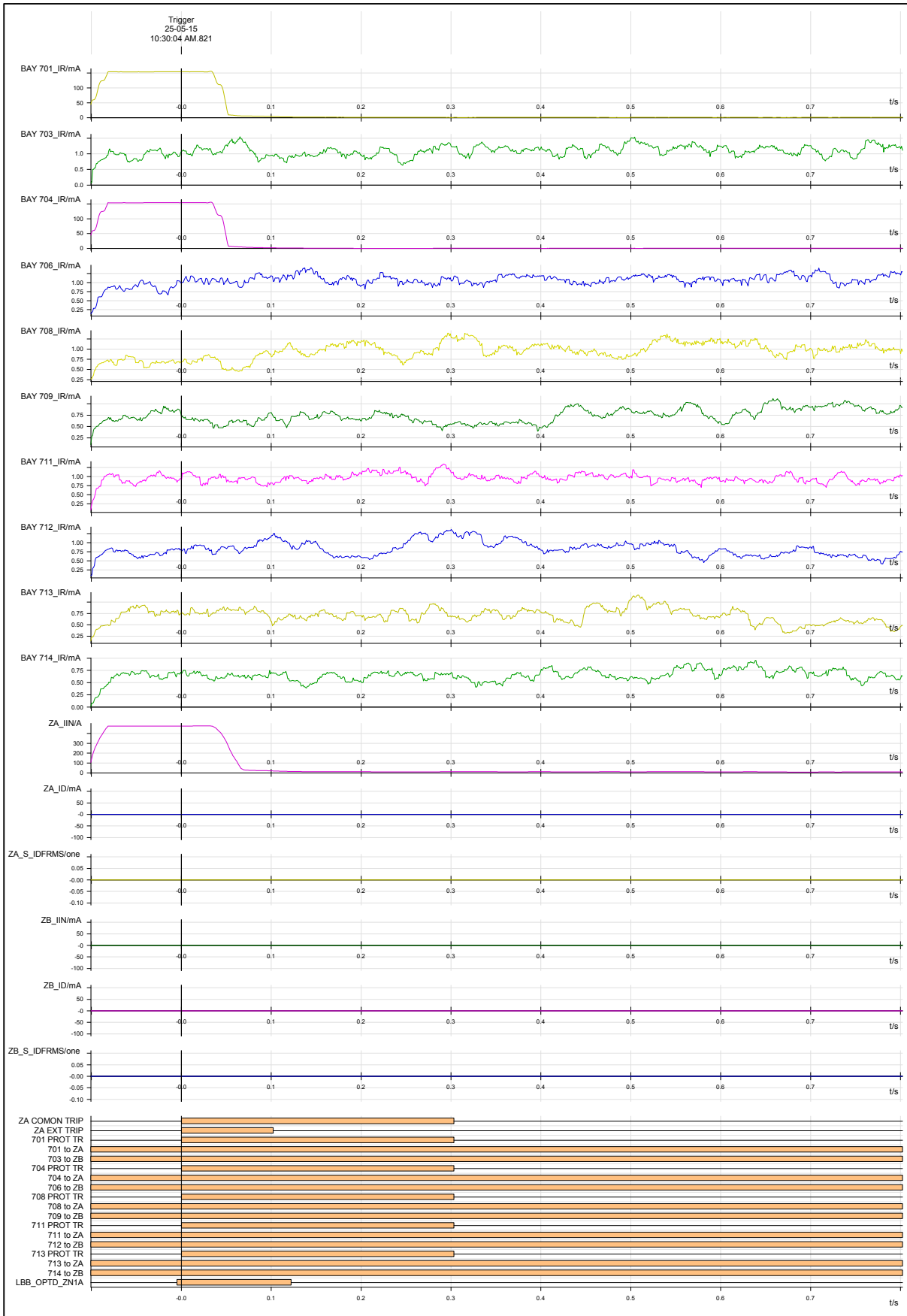
1. 765kV Bus-II
2. 765/400kV ICT#1.

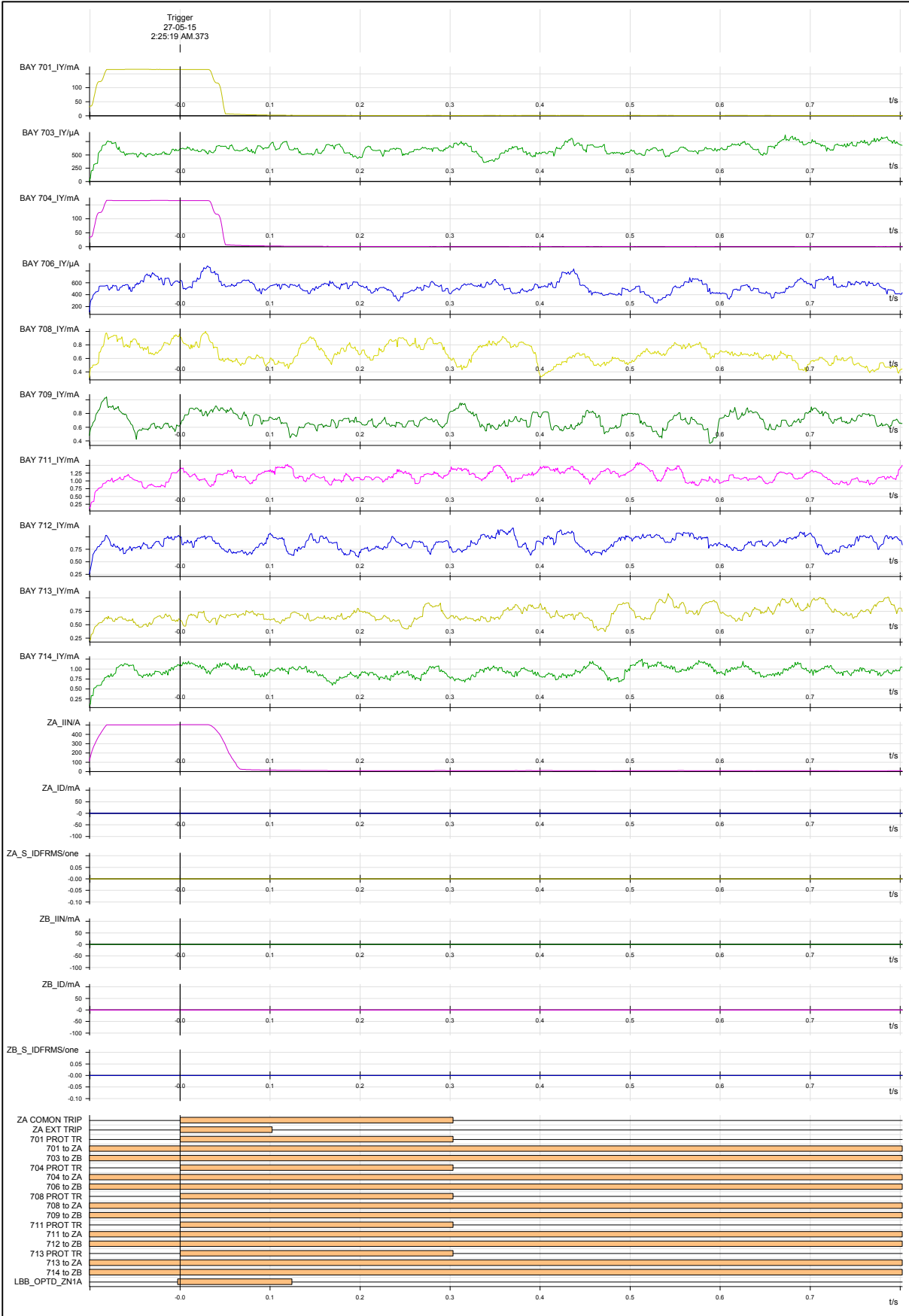
After Tripping: The following elements were tripped,

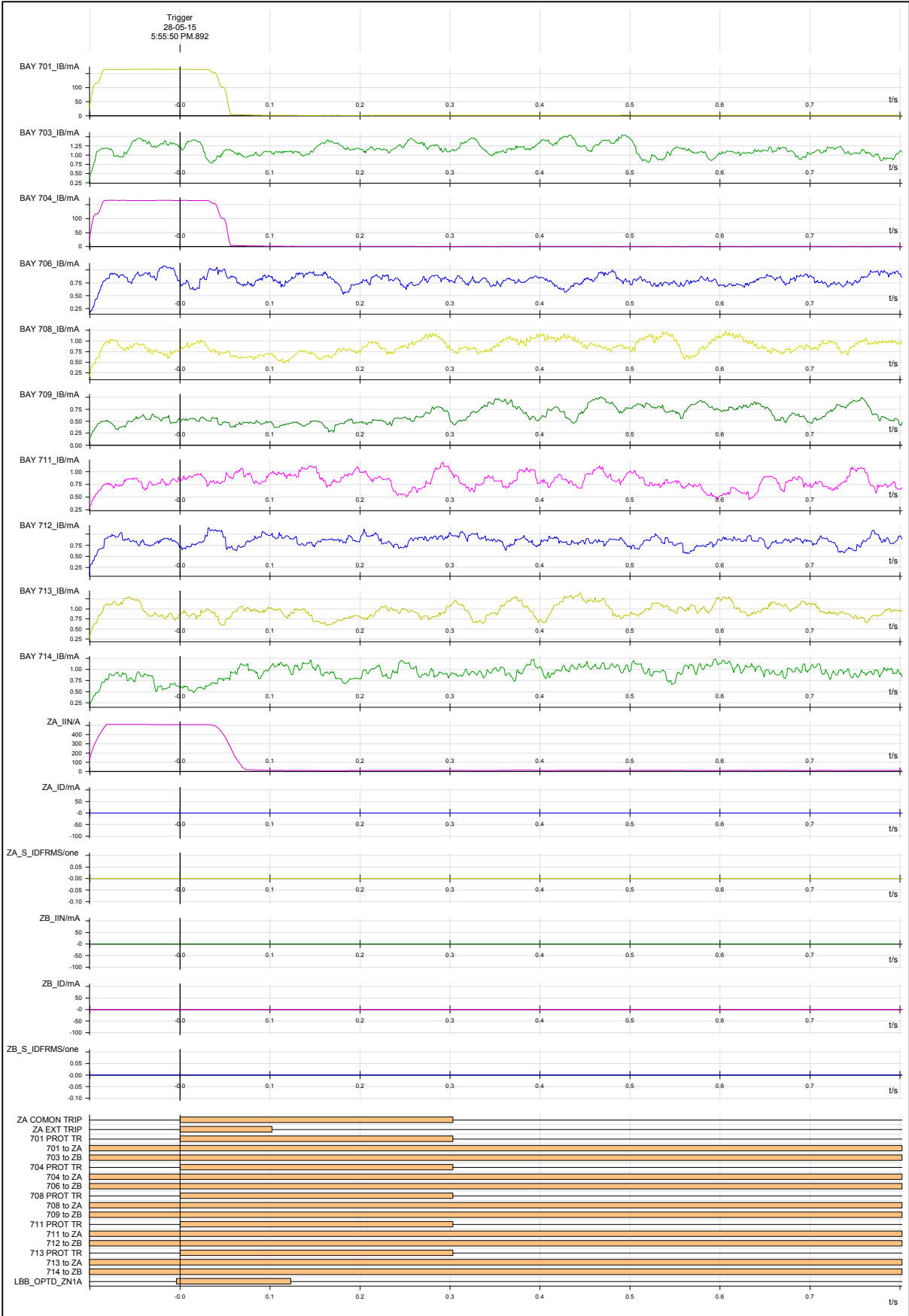
1. 765kV Bus-I
2. 765kV Champa-Durg S/C tripped on tripping of 70152 CB.
3. 765kV Champa-Kotra S/C tripped on tripping of 70452 CB.

DR & EL reports (Copies enclosed) are clearly indicating that there is no fault current and no protection initiation during this tripping. Inadvertent error while carrying out wiring termination work at adjacent bay for which construction work is under progress.

Annexure DR of Bus Bar protection







Grid Incidence at 400/220 kV Indore Sub-station on 18th March 2016

Event Category: GI-2

Event Date and Time: 18th March 2016, 01:22 Hrs

Event Summary:

At 01:22 Hrs, 400 kV R Phase CT of 400/220 kV 315 MVA ICT 4 got burst at 400/220 kV Indore Sub-station which resulted in Bus fault at the substation on 400 kV Bus 2. With this bus bar protection operated and tripped all elements connected to 400 kV Bus 2 at Indore. There was no load loss during the event.

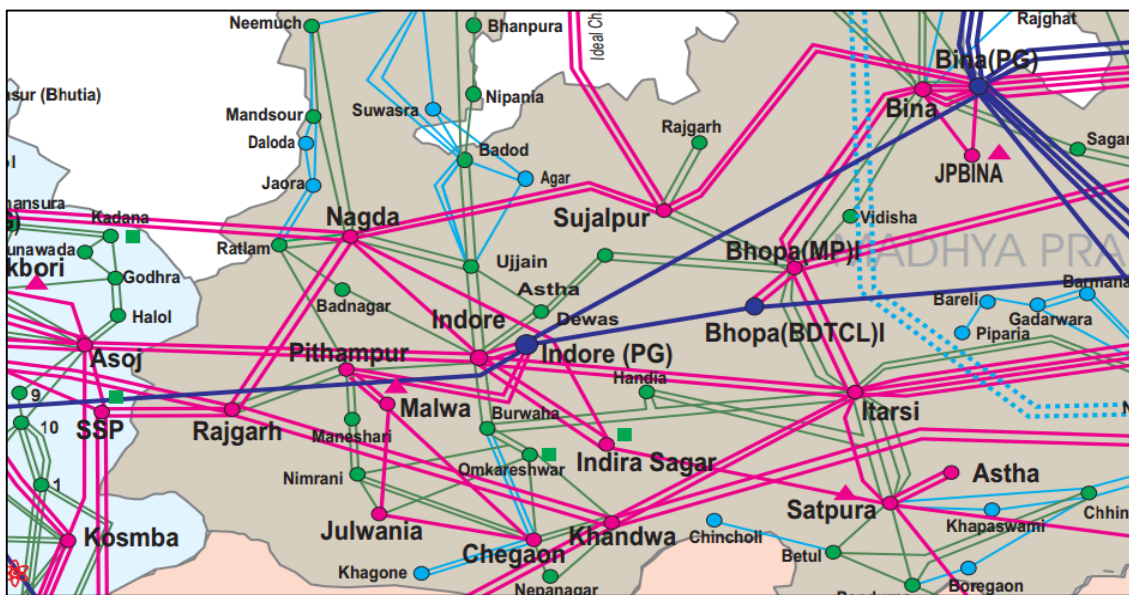


Figure 1 : Geographical Map

Event Analysis:

- 400/220 kV Indore Sub-station is a double Main transfer scheme sub-station. Prior to the event, all the elements at 400 and 220 kV level were in service except 400/220 kV ICT 3 which is out since 02-08-15.
- At 01:22 Hrs, the 400 kV Side R phase CT of the 400/220 kV ICT 4 which was on 400 kV Bus 2 got burst creating a Bus fault. With this the Bus bar protection operated for 400 kV Bus 2 and tripped all elements along with the Bus coupler. Also, the direct trip was sent the remote end of the transmission lines connected to 400 kV Bus 2.
- As observed from the PMU voltage plot from the Itarsi bus shown in figure 2, the fault has cleared within 120 ms. No DR/EL has been received from the sub-station.
- The Report received from Madhya Pradesh SLDC is attached as annexure for kind information.
- During this event, there was no load loss as 220 kV elements remain unaffected.

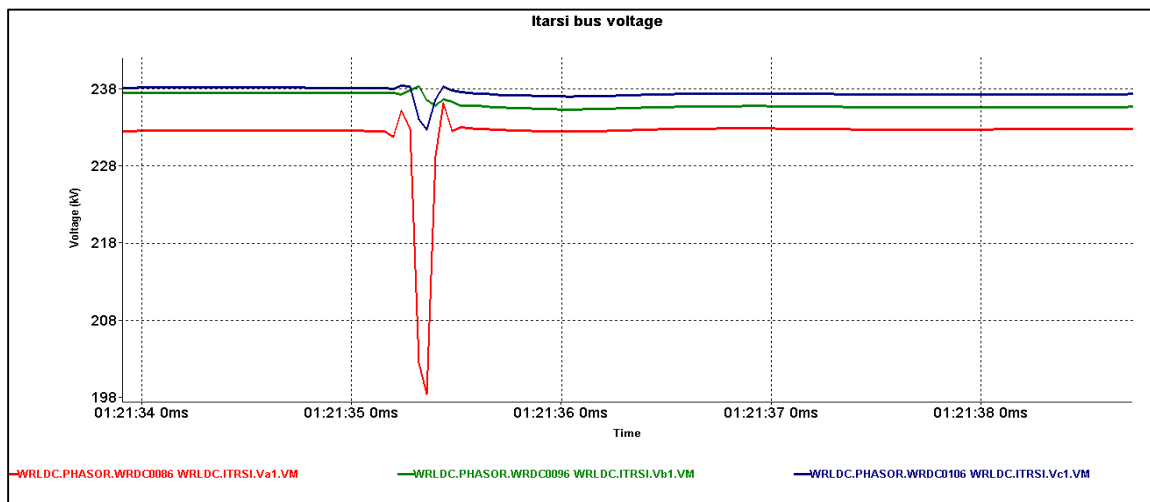


Figure 2 : 400 kV Itarsi Bus voltage from PMU indicating R phase fault due to CT burst and its clearance within 120ms.

- It was observed that 400 kV Indore-Asoj 1 & 2 circuit both were on 400 kV Bus 2 which was not desirable from the reliability and security point of view. As intimated by MPPTCL, there are issues with the isolator of the lines resulting in keeping both circuits on the same bus.

Remarks:

- The fault current during the event may kindly be checked and DR/EL of the event may kindly be send to WRLDC/WRPC for analysis. Non-Submission of DR/EI within 24 Hours is seen as a non-compliance of IEGC 5.2.r and CEA grid Standard 15.3.
- The reason for CT failure also need through analysis and the findings from the site may kindly be shared to WRLDC/WRPC. If the fault current is higher than other CT should also be tested in order to ensure their healthiness.
- PGCIL WR-2 is advised to immediately coordinate with MPPTCL in regard to Isolator replacement work at Indore Sub-station for PGCIL Bays. It is not advisable to keep parallel lines on the same bus.

Pre-Fault Condition

On dated 18.03.2016 at around 01:15 Hrs. MP System was normal and frequency of National Grid was 50.14HZ.

At 400 KV S/s Indore, all 400 KV feeders were in charged condition and normally loaded. 400/220 KV, 315 MVA ICT – I is out of service since 02.08.2015 and Double Main Transfer Bus scheme exists for 400 KV & 220 KV system at 400 KV S/s Indore.

Prior to fault feeder arrangement and loading of 400 KV feeders & 400/220 KV transformers at 400 KV S/s Indore were as follows:-

| 400 KV MAIN BUS – I | | |
|----------------------|---|---------------|
| S.No. | Name of Feeders/X'mers | Loading in MW |
| 1. | 400/220 KV, 315 MVA ICT – III | 120 |
| 2. | 400 KV Indore – Itarsi (PGCIL) Ckt – I | -305 |
| 3. | 400 KV Indore –Indore (PGCIL) Ckt – I | -228 |
| 4. | 400 KV Indore – Nagda Ckt. | 343 |
| 400 KV MAIN BUS – II | | |
| S.No. | Name of Feeders/X'mers | Loading in MW |
| 1. | 400/220 KV, 315 MVA ICT - II | 122 |
| 2. | 400/220 KV, 315 MVA ICT - IV | 119 |
| 3. | 400 KV Indore – Itarsi (PGCIL) Ckt– II | -307 |
| 4. | 400 KV Indore – Indore (PGCIL) Ckt–II | -216 |
| 5. | 400 KV Indore – Asoj (Gujarat) Ckt – I | 322 |
| 6. | 400 KV Indore – Asoj (Gujarat) Ckt – II | 322 |
| 7. | 400 KV Indore – ISP Ckt - II | -165 |

Occurrence

At around 01:22 Hrs. 400 KV 'R' - Phase CT of 400/220 KV, 315 MVA ICT – IV burst at 400 KV S/s Indore, resulting in 400 KV bus fault at 400 KV S/s Indore. Consequently Bus Bar protection of 400 KV Main Bus – II operated, resulting in tripping of all the elements connected to 400 KV Main Bus – II at 400 KV S/s Indore, which are as follows:-

| S.No. | Name of Feeder/transformer | Tripping End | Tripping Time | Indication |
|-------|------------------------------|-------------------|---------------|--------------------------------------|
| 1. | 400/220 KV, 315 MVA ICT – IV | 400 KV S/s Indore | 01:22 Hrs. | <u>Nagda end:-</u> Inst. Diff. Optd. |

| | | | | |
|----|--|----------------------|------------|---|
| 2. | 400/220 KV, 315 MVA ICT – II | 400 KV S/s Indore | 01:22 Hrs. | Bus Bar Protection operated. |
| 3. | 400 KV Bus Tie | 400 KV S/s Indore | 01:22 Hrs. | Bus Bar Protection operated. |
| 4. | 400 KV Indore – Itarsi (PGCIL) – II | Both end | | <u>400 KV S/s Indore:-</u> Bus Bar Protection operated. |
| | | | | <u>400 KV S/s Itarsi (PGCIL):-</u> DT Received. |
| 5. | 400 KV Indore – ISP Ckt – II | Both end | 01:22 Hrs. | <u>400 KV S/s Indore:-</u> Bus Bar Protection operated. |
| | | | | <u>400 KV S/s ISP HPS:-</u> DT Received. |
| 6. | 400 KV Indore – Indore (PGCIL) Ckt – II | Both end | 01:22 Hrs. | <u>400 KV S/s Indore:-</u> Bus Bar Protection operated. |
| | | | | <u>400 KV S/s ISP HPS:-</u> DT Received. |
| 7. | 400 KV Indore – Asoj Ckt – I | Both end | 01:22 Hrs. | <u>400 KV S/s Indore:-</u> Bus Bar Protection operated. |
| | | | | <u>400 KV S/s ISP HPS:-</u> DT Received. |
| 8. | 400 KV Indore – Asoj Ckt – II | Both end | 01:22 Hrs. | <u>400 KV S/s Indore:-</u> Bus Bar Protection operated. |
| | | | | <u>400 KV S/s ISP HPS:-</u> DT Received. |

During the above tripping no interruption occurred in any area.

Tripping details and relay indication furnished by Executive Engineer 400 KV Testing Division, MPPTCL, Indore are enclosed as – Annexure – I & II.

Remedial Measures

400 KV Main Bus – II at 400 KV S/s Indore was charged by charging 400 KV Bus TIE at 01:53 Hrs. subsequently following feeders and transformers were charged:-

1. 400 KV Indore – Itarsi (PGCIL) Ckt – II at 02:03 Hrs.
2. 400/220 KV, ICT – II at 400 KV S/s Indore – at 02:06 Hrs.
3. 400 KV Indore – Indore(PGCIL) Ckt – II – at 02:14 Hrs.
4. 400 Indore – ISP Ckt – II – at 02:21 Hrs.
5. 400 KV Indore – Asoj Ckt – I at 02:26 Hrs.

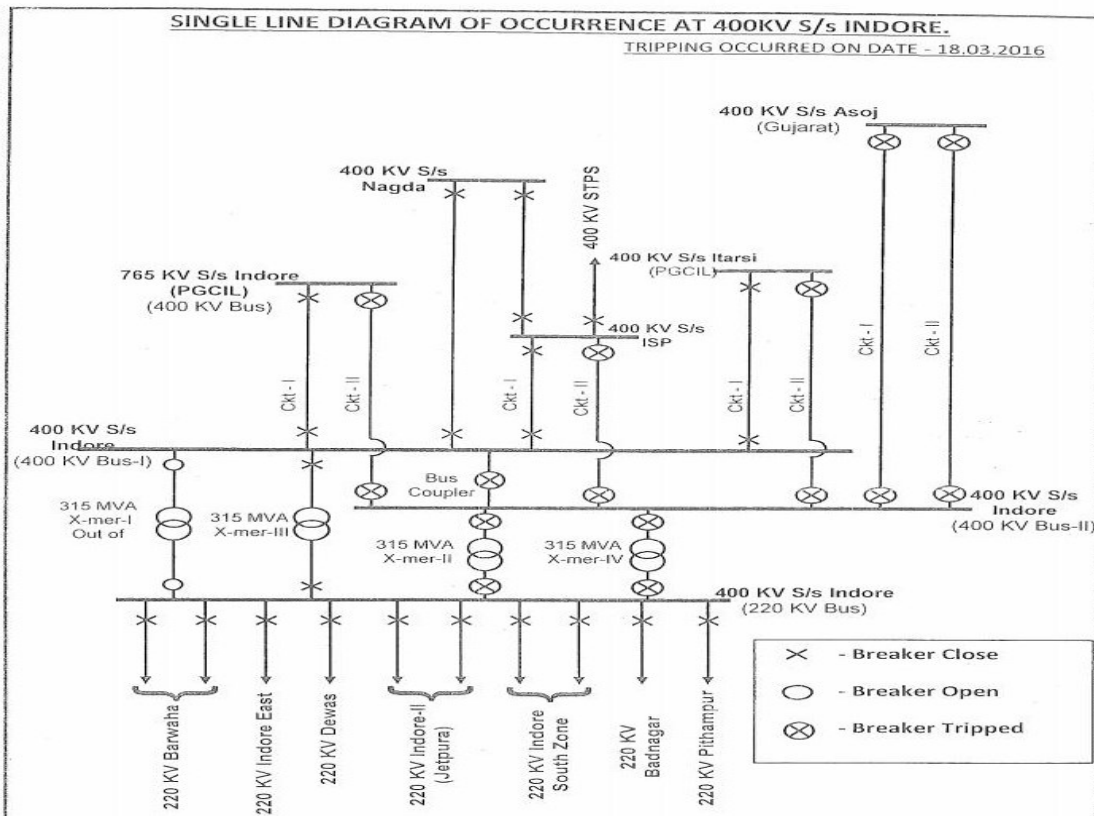
Conclusion

The above tripping occurred due to 400 KV 'R'- Phase CT of 400/220 KV, 315 MVA ICT – IV burst resulting in 400 KV Main Bus – II bus fault and operation of 400 KV Bus Bar Protection at 400 KV S/s Indore.

Generation Loss :- Nil

Load Loss

There was no Load Loss during the above tripping.



REPORTING OF OPERATIONAL EVENT / ACCIDENT OF 400 KV S/S INDORE OF DATED 18/03/2016
As Per IEGC 2010 & MPRGC 2005

ANNEXURE

| Sr.No | Details of tripping Incident | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------|---|---|--------|-------------|----------------------|------|----|-------------------|----------------|--------|----|-------------------|----------------|--------|----|-------------------|----------------|--------|----|-------------------|------------------|--------|----|-------------------|---------------|--------|----|-------------------|---------------|--------|----|-------------------|----------------|--------|----|-------------------|--------------------|--------|
| 01 | Time & date of event / tripping / disturbance | 18-march-2016 01:22 Hrs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 02 | Location | 400 KV S/s Indore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 03 | Plant and / or equipment directly involved (Line / Transformer / Unint) | HV Side R ph. CT Burst of 315 MVA ICT- IV failed at 400 KV S/S Indore and therefore 400 KV BUS-II Bus Bar Operated. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 04 | Description and cause of event | HV Side R ph. CT of 315 MVA ICT- IV failed at 01:22 Hrs on dtd 18.03.2016 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 05 | Antecedant conditions of load and generation, including frequency, voltage and time flows in the affected area at the time of tripping (Freq. S/D, Line & transformer O/L, O/V etc) | Due to HV Side R ph. CT Burst of 315 MVA ICT- IV following Feeders/Transformers of BUS-II tripped by BB protection relay:- <table border="1"> <thead> <tr> <th>sr.no.</th> <th>Name of S/S</th> <th>Name of feeder/X-mer</th> <th>Load</th> </tr> </thead> <tbody> <tr><td>1.</td><td>400 KV S/S Indore</td><td>315 MVA ICT IV</td><td>125 MW</td></tr> <tr><td>3.</td><td>400 KV S/S Indore</td><td>315 MVA ICT II</td><td>122 MW</td></tr> <tr><td>4.</td><td>400 KV S/S Indore</td><td>400 KV BUS TIE</td><td>208 MW</td></tr> <tr><td>5.</td><td>400 KV S/S Indore</td><td>400 KV ITARSI-II</td><td>309 MW</td></tr> <tr><td>6.</td><td>400 KV S/S Indore</td><td>400 KV ISP-II</td><td>134 MW</td></tr> <tr><td>7.</td><td>400 KV S/S Indore</td><td>400 KV ASOJ-I</td><td>316 MW</td></tr> <tr><td>8.</td><td>400 KV S/S Indore</td><td>400 KV ASOJ-II</td><td>312 MW</td></tr> <tr><td>9.</td><td>400 KV S/S Indore</td><td>400 KV HATUNIYA-II</td><td>218 MW</td></tr> </tbody> </table> | sr.no. | Name of S/S | Name of feeder/X-mer | Load | 1. | 400 KV S/S Indore | 315 MVA ICT IV | 125 MW | 3. | 400 KV S/S Indore | 315 MVA ICT II | 122 MW | 4. | 400 KV S/S Indore | 400 KV BUS TIE | 208 MW | 5. | 400 KV S/S Indore | 400 KV ITARSI-II | 309 MW | 6. | 400 KV S/S Indore | 400 KV ISP-II | 134 MW | 7. | 400 KV S/S Indore | 400 KV ASOJ-I | 316 MW | 8. | 400 KV S/S Indore | 400 KV ASOJ-II | 312 MW | 9. | 400 KV S/S Indore | 400 KV HATUNIYA-II | 218 MW |
| sr.no. | Name of S/S | Name of feeder/X-mer | Load | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. | 400 KV S/S Indore | 315 MVA ICT IV | 125 MW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | 400 KV S/S Indore | 315 MVA ICT II | 122 MW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. | 400 KV S/S Indore | 400 KV BUS TIE | 208 MW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. | 400 KV S/S Indore | 400 KV ITARSI-II | 309 MW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. | 400 KV S/S Indore | 400 KV ISP-II | 134 MW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. | 400 KV S/S Indore | 400 KV ASOJ-I | 316 MW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8. | 400 KV S/S Indore | 400 KV ASOJ-II | 312 MW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. | 400 KV S/S Indore | 400 KV HATUNIYA-II | 218 MW | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 06 | Post occurrence position (Freq. S/D, Line & transformer O/L, O/V etc) | 417/228 KV. Freq.50.06Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| 07 | System and areas affected | No any System and areas affected. Load managed by one ICT and near by SS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------|--|--|---------------|------------------|----------------------|---------------|------------------|----|-------------------|----------------|-------|-------|----|-------------------|------------------|-------|-------|----|-------------------|----------------|-------|-------|----|-------------------|--------------------|-------|-------|----|-------------------|---------------|-------|-------|----|-------------------|---------------|-------|-------|----|-------------------|----------------|-------|--|
| 08 | Damage to equipment , if any | R ph. CT failed of 315 MVA ICT- IV HV Side | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 09 | Supply Interrupted (MW & MWh), if applicable, | NIL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | Amount of Generation loss (MW & MWh), if applicable | NIL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Alternate Supply arrangement if arranged | No | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Estimate of actual time to return service | supply restored at 01:53 Hrs at 400 KV S/S on 400 KV bus-II | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | All relevant system data including copies of poorf of all recording instruments including DR,ER, DAS, etc. | Tripping details and indications enclosed in annexure-1. DR file enclosed | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | Sequence of tripping with time. | Following Feeders/X-Mers are affected <table border="1"> <thead> <tr> <th>sr.no.</th> <th>Name of S/S</th> <th>Name of feeder/X-mer</th> <th>Tripping Time</th> <th>Restoration Time</th> </tr> </thead> <tbody> <tr><td>1.</td><td>400 KV S/S Indore</td><td>400 KV BUS TIE</td><td>01:22</td><td>01:53</td></tr> <tr><td>2.</td><td>400 KV S/S Indore</td><td>400 KV ITARSI-II</td><td>01:22</td><td>02:03</td></tr> <tr><td>3.</td><td>400 KV S/S Indore</td><td>315 MVA ICT II</td><td>01:22</td><td>02:06</td></tr> <tr><td>4.</td><td>400 KV S/S Indore</td><td>400 KV HATUNIYA-II</td><td>01:22</td><td>02:14</td></tr> <tr><td>6.</td><td>400 KV S/S Indore</td><td>400 KV ISP-II</td><td>01:22</td><td>02:21</td></tr> <tr><td>7.</td><td>400 KV S/S Indore</td><td>400 KV ASOJ-I</td><td>01:22</td><td>02:26</td></tr> <tr><td>8.</td><td>400 KV S/S Indore</td><td>315 MVA ICT IV</td><td>01:22</td><td></td></tr> </tbody> </table> | sr.no. | Name of S/S | Name of feeder/X-mer | Tripping Time | Restoration Time | 1. | 400 KV S/S Indore | 400 KV BUS TIE | 01:22 | 01:53 | 2. | 400 KV S/S Indore | 400 KV ITARSI-II | 01:22 | 02:03 | 3. | 400 KV S/S Indore | 315 MVA ICT II | 01:22 | 02:06 | 4. | 400 KV S/S Indore | 400 KV HATUNIYA-II | 01:22 | 02:14 | 6. | 400 KV S/S Indore | 400 KV ISP-II | 01:22 | 02:21 | 7. | 400 KV S/S Indore | 400 KV ASOJ-I | 01:22 | 02:26 | 8. | 400 KV S/S Indore | 315 MVA ICT IV | 01:22 | |
| sr.no. | Name of S/S | Name of feeder/X-mer | Tripping Time | Restoration Time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. | 400 KV S/S Indore | 400 KV BUS TIE | 01:22 | 01:53 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. | 400 KV S/S Indore | 400 KV ITARSI-II | 01:22 | 02:03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | 400 KV S/S Indore | 315 MVA ICT II | 01:22 | 02:06 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. | 400 KV S/S Indore | 400 KV HATUNIYA-II | 01:22 | 02:14 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. | 400 KV S/S Indore | 400 KV ISP-II | 01:22 | 02:21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. | 400 KV S/S Indore | 400 KV ASOJ-I | 01:22 | 02:26 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8. | 400 KV S/S Indore | 315 MVA ICT IV | 01:22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | Details of relay flags. | enclosed in annexure-1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | Remedial measure. | Faulty CT Replaced | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | Recommendations for future improvement to avoid repetition of incident | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | Any other information | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Executive Engineer
400KV Testing Dn.
M.P.P.T.C.L. Indore

ANNEXURE - II

Annexure I

REPORTING OF OPERATIONAL EVENT / ACCIDENT OF 400 KV S/S INDORE OF DATED 18/03/2016

Relay Indication

| S. N. | Name of S/s | Xmers / Feeder | Indore End | Remote End |
|-------|------------------|--------------------|-------------------|------------|
| 1 | 400KV S/S Indore | 3X105 MVA ICT-II | B/B Opted. | - |
| 2 | | 315 MVA ICT-IV | Inst. Diff. Optd. | - |
| 3 | | 400 KV Bus Coupler | B/B Opted. | - |
| 4 | | 400 KV Itarsi-II | B/B Opted. | DT recive |
| 5 | | 400 KV ISP-II | B/B Opted. | DT recive |
| 6 | | 400 KV Asoj-I | B/B Opted. | DT recive |
| 7 | | 400 KV Asoj-II | B/B Opted. | DT recive |
| 8 | | 400 KV Hatuniya-II | B/B Opted. | DT recive |

Executive Engineer
400KV Testing Dn.
M.P.P.T.C.L. Indore

Grid Incidence at 220/132 kV Satna (MP) Sub-station on 7th March 2016

Event Category: GI-1

Event Date and Time: 7th March 2016, 17:10 Hrs

Event Summary: At around 17:10 Hrs, 132 kV Satna-Majhgawan circuit tripped on R-phase disk failure and conductor snapping. At the same time LBB protection of 132 kV Satna – Satna Cement circuit Mal-operated at 220 kV Satna S/s resulting in tripping of all connected ICTs and Feeders connected to 132 kV Bus at 220/132 kV Satna S/s. This has resulted in load loss of 170 MW and energy unserved in tune of 19.5 MWhr.

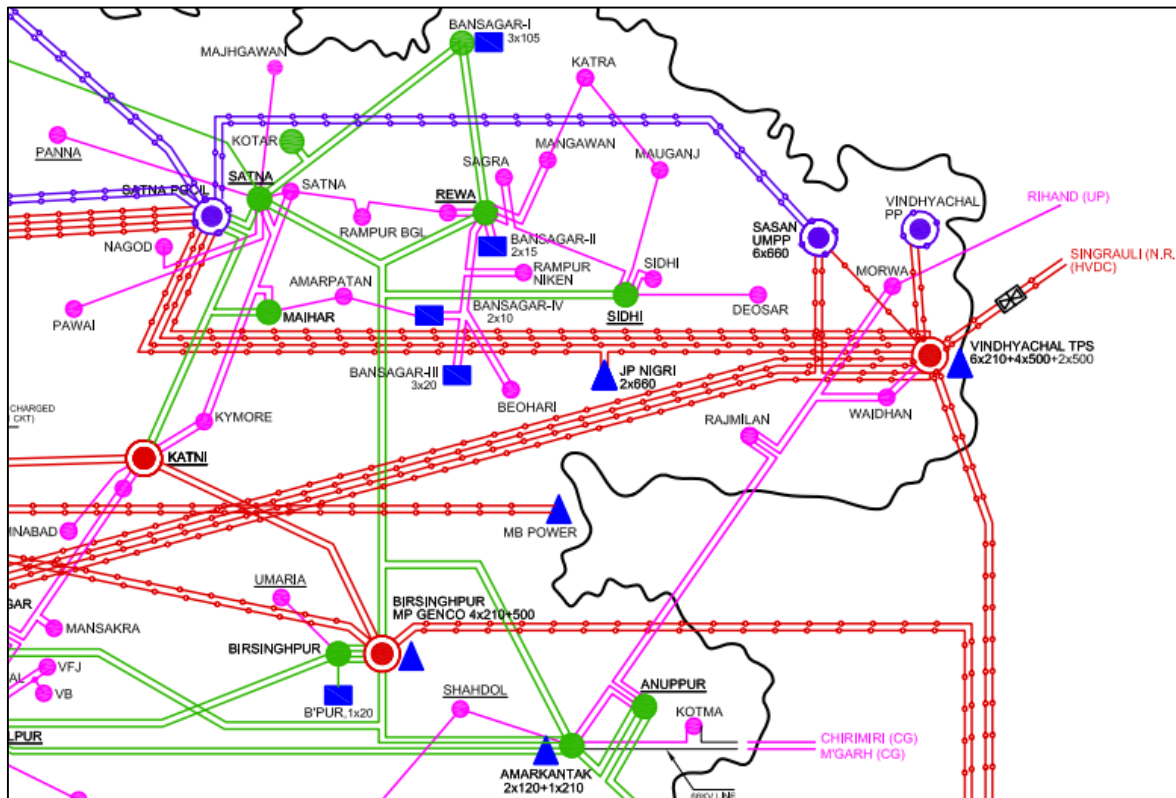


Figure 1 : Geographical Map

Event Analysis: Based on the details submitted by MPPTCL, SOE and PMU data the event has been analyzed. The 220 kV and 132 kV switchyard at Satna is having Double main transfer scheme. However at 132 kV level there is no bus bar protection. Further the 132 kV bus coupler between 132 kV bus 1 and Bus 2 has also not been commissioned so buses are made parallel by closing the isolators.

It was found that R Phase fault has occurred on the 132 kV Satna-Majhgawan circuit which tripped. However after 200 ms of this, the LBB of 132 kV Satna-Satna cement circuit misoperated causing the tripping of all 132 kV lines/ICTs from the sub-station due to extension of tripping to all breakers from the LBB scheme.

Table 1: SOE from WRLDC SCADA

| Element | Sub-station | Status | Time (hh:mm:ss) | Millisecond |
|-----------------------------|---------------------|-------------|-----------------|-------------|
| SATNA MANJHGAWAN 132 CB | Satna 220 kV | Faulty | 17:09:29 | 390 |
| SATNA PRISM 132 CB | Satna 220 kV | Open | 17:09:29 | 640 |
| SATNA 220/132S TR1 CB | Satna 220 kV | Faulty | 17:09:29 | 641 |
| SATNA 220/132S TR2 CB | Satna 220 kV | Open | 17:09:29 | 643 |
| SATNA -STNCEM 132 CB | Satna 220 kV | Open | 17:09:29 | 644 |
| SATNA 132/33P TR4 CB | Satna 220 kV | Faulty | 17:09:29 | 657 |
| SATNA PAWAI 132 CB | Satna 220 kV | Open | 17:09:29 | 658 |
| SATNA -I/C II 132 CB | Satna 220 kV | Open | 17:09:29 | 668 |

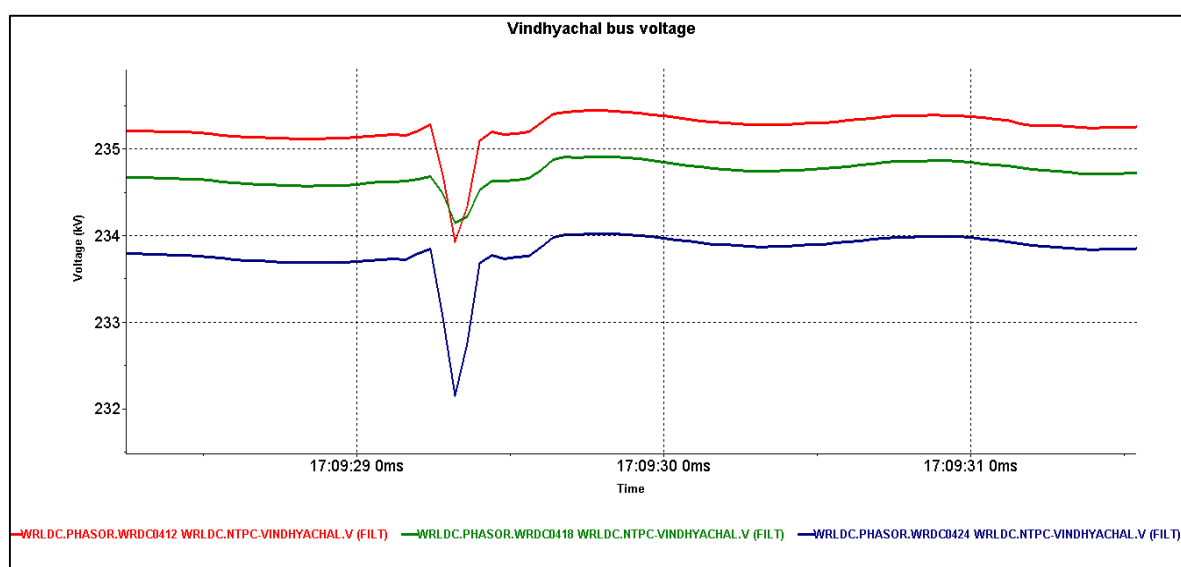


Figure 2 : 400 kV Vindhyachal voltage indicating R as well as B phase to E/F.

Remarks and Recommendation:

- The 132 kV Bus coupler should be commissioned at the 220/132 kV Sub-station. The non-commissioning has resulted in non-utilization of the DMT scheme and limiting the flexibility to system operator and reliability to the Consumers. **MPPTCL may kindly send the present status of 132 kV Bus coupler and Madhya Pradesh SLDC may kindly monitor the same at their end.**
- 132 kV Bus bar protection system should also be commissioned at the sub-station. This is in line with the *CEA Regulation for Measures relating to Safety and Electric Supply 2010 -45.2.vii* states that all 132 kV should be provided with bus bar protection system. **MPPTCL may kindly send the present status of 132 kV Bus bar protection system and Madhya Pradesh SLDC may kindly monitor the same at their end.**

Pre-Fault Condition

On dated 07.03.2016 at around 17:05 Hrs. MP System was normal and frequency of National Grid was 50.16 Hz. For load management & to restrict the overloading on 400/220 kV Satna ICTs, following arrangement was made at 200 kV S/s Satna :-

1. 220 kV Satna(PG) – Maihar Ckt – open.
2. 220 kV Tons Rewa Ckt – I & II – open.
3. 132 kV Satna – Maihar Ckt – open.
4. 132 kV Satna – Kymore Ckt – open.
5. 132 Rewa – Rampur Baghelan Ckt – open.
6. 132 kV Chattarpur – Bijawar Ckt – open.

At 220 kV S/s Satna Double Main Transfer Scheme exists for 220 kV & 132 kV system. 132 kV Bus Bar Protection does not exist and 132 kV Bus Tie is also not commissioned at 220 kV S/s Satna, hence both 132 kV Buses are made parallel through isolators.

Occurrence

At around 17:10 Hrs., 132 kV Satna – Majhgawan Ckt tripped due to R-phase Disk failure at Loc. No.103 and conductor snapping. At the same time LBB protection of 132 kV Satna – Satna Cement Ckt Mal-operated at 220 kV S/s Satna resulting in tripping of all feeders and transformers connected to 132 kV Bus at 220 kV S/s Satna which are as follows:-

1. 220/132 kV, 160 MVA AREVA make X'mer from 132 kV side at 220 kV S/s Satna.
2. 220/132 kV, 160 MVA AREVA make X'mer from 132 kV side at 220 kV S/s Satna.
3. 132/33 kV, 63 MVA X'mer at 220 kV S/s Satna.
4. 132/33 kV, 40 MVA X'mer at 220 kV S/s Satna.
5. 132 kV Satna – Panna Ckt.
6. 132 kV Satna – Pawai Ckt.
7. 132 kV Satna – Nagod Ckt.
8. 132 kV Satna – Satna Cement.
9. 132 kV Satna – Prism Cement.
10. 132 kV Interconnector – I & II.

Due to the above tripping interruption occurred at following substations:-

1. 132 kV supply 220 kV S/s Satna.
2. 132 kV S/s Majhgawan.
3. 132 kV S/s Satna.

4. 132 kV S/s Rampur Baghelan.
5. 132 kV S/s Nagod.
6. 132 kV S/s Pawai.
7. 132 kV S/s Panna.
8. Satna Cement.
9. Prism Cement.

The relay indications appeared in various transmission elements forwarded by the Superintending Engineer (T&C), MPPTCL, Satna is given below:

| DAILY TRANSMISSION SYSTEM REPORT 07 MARCH-2016 | | | | | | | | | |
|--|-----------|-----------------------------------|-------|-------|----------|---|---------------|---------------------------|---|
| | EHV S/s | Name of feeder/ X-mer (A-B) | Time | | Duration | Indications-A | Indications-B | Analysis | Remarks |
| Satna | Satna 220 | 132 kv Majhgawan | 17:10 | 17:16 | 0:06 | A-N Ph, Zone-I, 38.2 km. LBB Relay Operate. | | Selective Tripping. | Transient Fault (Radial supply) Feeder not hold again trip. |
| | | 160 Mva X-mer Areva | 17:10 | 17:13 | 0:03 | Due to LBB Relay Operate. | | Due to LBB Relay Operate. | Due to LBB Relay Operate. |
| | | 160 Mva X-mer BHEL | 17:10 | 17:14 | 0:04 | | | | |
| | | 63 Mva X-mer BBL | 17:10 | 17:15 | 0:05 | | | | |
| | | 40 Mva X-mer ABB | 17:10 | 17:20 | 0:10 | | | | |
| | | 132 kv Panna | 17:10 | 17:15 | 0:05 | | | | |
| | | 132 kv Nagod | 17:10 | 17:15 | 0:05 | | | | |
| | | 132 kv Pawai | 17:10 | 17:15 | 0:05 | | | | |
| | | 132 kv Satna cement. | 17:10 | 17:15 | 0:05 | | | | |
| | | 132 kv Prism cement. | 17:10 | 17:15 | 0:05 | | | | |
| | | 132 kv Satna I/C-I | 17:10 | 17:20 | 0:10 | | | | |
| 132 kv Satna I/C-II | 17:10 | 17:18 | 0:08 | | | | | | |

Restoration

132 kV supply at 220 kV S/s Satna was resumed by charging 220/132 kV, 160 MVA Areva X'mer at 220 kV S/s Satna at 17:13 Hrs. Simultaneously following feeders & transformers were charged:-

1. 220/132 kV, 160 MVA BHEL X'mer at 220 kV S/s Satna – at 17:14 Hrs.
2. 132/33 kV, 63 MVA X'mer at 220 kV S/s Satna – at 17:15 Hrs.
3. 132 kV Satna – Panna Ckt – at 17:15 Hrs.
4. 132 kV Satna – Pawai Ckt – at 17:15 Hrs.
5. 132 kV Satna – Nagod Ckt – at 17:15 Hrs.
6. 132 kV Satna – Satna Cement – at 17:15 Hrs.
7. 132 kV Satna – Prism Cement – at 17:15 Hrs.
8. 132 kV Satna Interconnector – II – at 17:18 Hrs.
9. 132/33 kV, 40 MVA X'mer at 220 kV S/s Satna – at 17:20 Hrs.
10. 132 kV Satna Interconnector – I – at 17:20 Hrs.

Conclusion

- The above tripping occurred as R-phase Disk failure at Loc. No.103 and conductor snapping of 132 kV Satna – Majhgawan Ckt and LBB protection of 132 kV Satna – Satna Cement Ckt Mal-

operated at 220 kV S/s Satna resulting in tripping of all feeders and transformers connected to 132 kV Bus at 220 kV S/s Satna.

- Mal-operation of 132 kV LBB shall be checked and charging of faulty element/line multiple times shall be avoided and standing instructions should be followed strictly. Further it has been informed by EE, (T&C), MPPTCL, Satna, that no fault has been found on the feeder which shall be investigated.
- Failed R-phase disc at Loc No. 103 of 132 kV Satna – Majhgawan Ckt replaced and Ckt charged at 11:10 Hrs. on 08.03.2016.

Load Loss

Load Loss was approx. **117 MW, for about 10 min; 19.5 MWH. At 220 kV S/s Satna &** supply at 132 kV S/s Majhgawan was interrupted for about 6 Hrs., hence load loss at 132 kV S/s Majhgawan was about 11 MW for about 6 Hrs.; 66MWH. Thereafter 33 kV Back feed supply was taken at 23:10 Hrs. thus total load loss was 85.5MWH.

Grid Incidence at SSP 220 kV CHPH sub-station on 22nd December 2015

Event Category: GI-1

Event Date and Time: 22nd December 2015, 08:45 Hrs

Event Summary: Due to operation of pilot wire differential protection scheme of 220 kV RBPH-CHPH line 1, circuit got tripped resulting in loss of outgoing line from 220 kV Bus 1 of CHPH (220 kV bus coupler was in open condition). This led to tripping of 220 kV Bus 1 and connected unit 1, 3, 5. The generators tripping led to loss of generation to the tune of 81 MW.

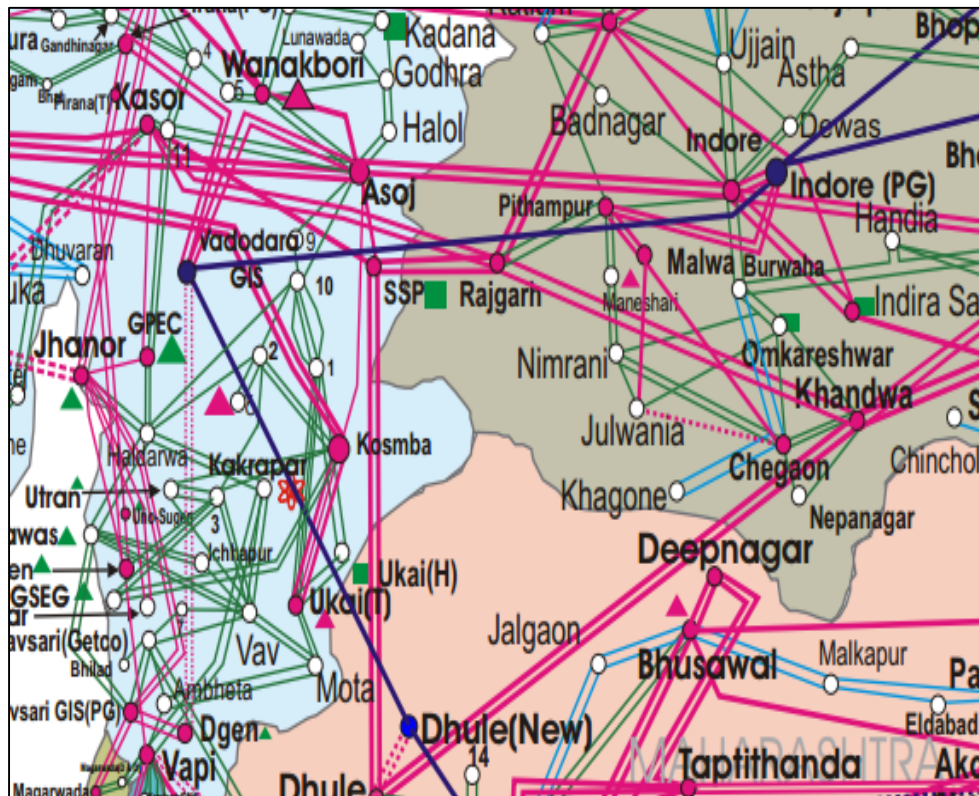


Figure 1 : Geographical Map

Event Overview and Analysis:

Based on the details received and the preliminary information available, the event is analyzed as following:

- At Canal Head Power House (CHPH) of SSP power plant 220 kV DMT scheme is present. The 220 kV end of 400/220 kV ICTs at River Bed Power House (RBPH) is terminated at 220 kV buses of CHPH through 220 kV lines (length =9 km). So there is no 220 kV yard at RBPH sub-station. The bus coupler of the 220 kV buses of the CHPH sub-station was in open condition.
- At 08:45 Hrs, 220 kV RBPH (River Bed power house)-CHPH (canal head power house) circuit 1 tripped on the pilot wire differential protection operation at 400/220 kV RBPH sub-station. This led to loss of evacuation from the 220 kV Bus 1 and Unit 1, 3 and 5 connected at CHPH station. With this all the units tripped on their protection scheme as given in table 1.
- Reason for tripping of circuit on pilot wire differential protection is not mentioned by the utility in their report.

Table 1 : Sequence of events

| Elements | Tripping Time | Relay Indication at End 1 | Relay indication at End 2 | Restoration Time |
|--------------------|---------------|--|---------------------------|------------------|
| 220 kV Bus 1 | 08:45 | Dead as Incoming line tripped | | Not Available |
| 220 kV CHPS-RBPH 1 | 08:45 | Pilot Wire differential prot. optd. Remote trip Signal Received. | | Not Available |
| 50 MW Unit 1 | 08:45 | (1) Emergency Shut Down, (2) Control Action Shut Down, (3) Master Trip Relay 86L Optd, (4) 15% Over Speed & G.V. Not Closing. (5) Excitation System Fault Stage-1, (6) Gen. Under Voltage, (7) Loss Of Thy. Bridge, (8) Seq. Optd.Time. 86 L Operated. | | 09:15 |
| 50 MW Unit 3 | 08:45 | (1) Emergency Shut Down, (2) Control Action Shut Down, (3) Master Trip Relay 86L Optd, (4) 15% Over Speed & G.V. Not Closing. (5) Excitation System Fault Stage-1, (6) Gen. Under Voltage, (7) Loss Of Thy. Bridge, (8) Seq. Optd.Time. 86 L Operated. | | 09:45 |
| 50 MW Unit 5 | 08:45 | (1) Emergency Shut Down, (2) Control Action Shut Down, (3) Master Trip Relay 86L Optd, (4) 15% Over Speed & G.V. Not Closing. (5) Excitation System Fault Stage-1, (6) Gen. Under Voltage, (7) Loss Of Thy. Bridge, (8) Seq. Optd.Time. 86 L Operated. | | 10:10 |

* Based on Report from CHPH

Protection and Operation Related Issues and Suggested remedial action:

- **SSP/NCA may kindly provide the details for the reason of operation of pilot wire differential protection scheme at CHPH.** Initially it was intimated that pilot wire of the circuit has snapped and it fell on 220 kV Bus 1 causing bus fault. However from the details send later on nothing of such kind of event is mentioned in the report.
- The reason for keeping the bus coupler open is not understood at CHPH sub-station. In case of tripping of line on pilot wire protection the unit could remain in service through Bus 2 and line 2. **SSP/NCA may kindly send the detail for keeping such arrangement. Whether any code was taken from WRLDC to keep the bus coupler remain out of service.**

From the past record it is learnt that during the event on 9th September 2014, when bus fault occurred on 400 kV Bus 1 at RBPH, 400/220 kV ICT 1 got tripped and caused loss of 220 kV Bus 1 at CHPH also as the 220 kV bus coupler was kept in open condition. This bus coupler was kept open as there was no protection scheme for the 220 kV CHPH-RBPH circuit at that time. However it is understood from above tripping that the differential line protection scheme is implemented so, the bus coupler should be kept in close position. Further

**NCA/SSP may also kindly inform whether Bus bar protection scheme is in service at 220 kV
CHPH sub-station or not?.**

Detailed report of the occurrence at 220/33 kV Halkarni Sub-station on 13th December 2015

1. **Event Category :** GD-1
2. **Event Date and Time :** 13th December 2015, 15:40 Hrs
3. **Event Summary:** Halkarni sub-station is having a single bus scheme. At 15:40 Hrs, R phase CT of 220 kV Halkarni-Mahalaxmi line burst at 220 kV Halkarni end causing bus fault. With this the 220 kV Bus bar protection operated at Halkarni sub-station and all 220 kV elements tripped. This led to loss of Hemarus cogeneration plant and Mahalaxmi generation causing generation loss of 18.1 MW and 220/33 kV ICTs tripping leading to load loss in tune of 20 MW. Detailed report from MSETCL is attached as annexure.

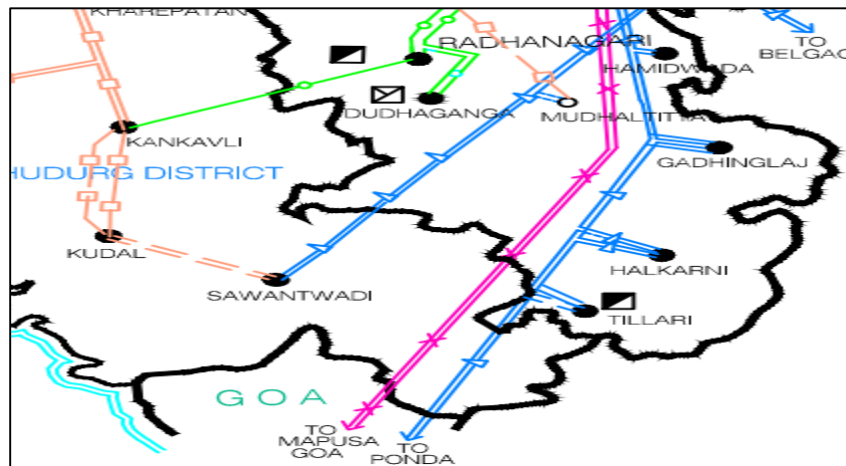


Figure 1 : Geographical Network Diagram

Load / Generation affected: Load and generation loss were 20 MW and 18.1 MW respectively. Energy unserved during the event was 9 MWhr.

Frequency Change : No significant change in frequency was observed.

Analysis : Only PMU data from Solapur was available with WRLDC for analysis. From the plot it was observed that fault in R phase got cleared within 160 ms (Figure 2). Another dip within 600 ms is observed in Y phase whose reason is not known.

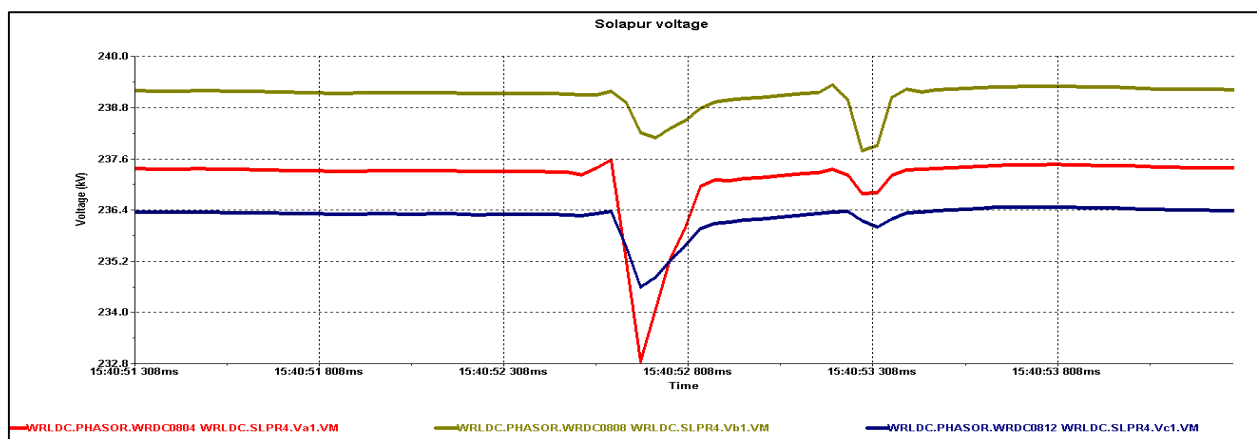


Figure 2: 400 kV Solapur Bus voltage during the fault as observed from PMU

Remarks:

- Analysis for the actual reason for CT failure may kindly be done by MSETCL in order to know whether it was due to age or insulation failure. Also, the make along with manufacturing and installation year may kindly be shared with WRLDC.
- MSETCL is also advised to do the testing of all CTs at Halkarni and nearby station and replace any CT which shows deviation from the desired values of Capacitance and $\tan\delta$.
- MSETCL may kindly send the DR/EL for any such faults to WRLDC/WRPC as per the grid code.
- Further, Goa Electricity department may kindly check their relay setting as it is observed that relay at Amona has overreached to large extent during the above event. Corrective action taken in this regard may kindly be informed to WRLDC/WRPC



MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO. LTD.
CIN No. U40109MH2005SGC153646

| | |
|--|---|
| From: Superintending Engineer, Testing & Communication Circle, Administrative Bldg, Ground Floor, At-Vijaynagar, Post - Supane, Tal-Karad, Dist: Satara.- 415 114. Contact No.: 02164-255211, 255155 E-mail: - E-mail:se3500@mahatransco.in | To <u>The Chief Engineer</u> <u>EHV CC (O&M) Zone,</u> <u>Karad.</u> |
|--|---|

Ref No. SE/TCC/KRD/T-93/ **NO 299 - 7** Date: **28 DEC 2015**

Sub :- Occurrence analysis of 220 KV Bus bar protection operation at 220 KV Halkarni S/Stn.
on Dtd. 13:12:2015 at 15:40 Hrs.

Ref :- EE/TEST/KOP/TECH/No. 460 Dtd. 15.12.2015

On Dt. 13.12.2015 at 15:40Hrs. 220 KV 'R' ph. CT burst and 220KV Busbar protection is operated.
The Window & Relay indication at time of occurrence is as given below:

| Sr. No. | Feeder | Date & time of occurrence | Date & time of Restoration Time | Relay Indication | | Remark |
|---------|---|---------------------------|---------------------------------|---|---|--|
| | | | | Local End | Remote End | |
| 1 | 220 KV Bus Bar Prot.operation at 220 KV Halkarni S/Stn. | 13/12/2015 at 15:40 Hrs | 13/12/2015 at 16:07 Hrs | 1) BS - Trip 2) BBP- Bus 1 3) Misallaneous alarm 4) All bays 96 Trip relay Operation | - | |
| 2 | 220 KV Halkarni-Mumewadi Ckt. 1 | 13/12/2015 at 15:40 Hrs | 13/12/2015 at 16:07 Hrs | WI :- Bus bar prot.Optd RI:- 96 Trip | WI :- Nil RI:- Nil | |
| 3 | 220 KV Halkarni-Mumewadi Ckt. 2 | 13/12/2015 at 15:40 Hrs | 13/12/2015 at 16:07 Hrs | | | |
| 4 | 220 KV Halkarni-Tillari Ckt | 13/12/2015 at 15:40 Hrs | 13/12/2015 at 16:08 Hrs | | | |
| 5 | 220 KV Halkarni-Olam Agro(Hemrus) | 13/12/2015 at 15:40 Hrs | 13/12/2015 at 16:08 Hrs | | | |
| 6 | 220/33 KV 25 MVA T/F No. 1 CGL | 13/12/2015 at 15:40 Hrs | 13/12/2015 at 16:10 Hrs | | | |
| 7 | 220/33 KV 25 MVA T/F No. 2 VIJAI | 13/12/2015 at 15:40 Hrs | 13/12/2015 at 16:08 Hrs | | | |
| 8 | 220 KV Halkarni-Mahalaxmi Ckt. | 13/12/2015 at 15:40 Hrs | 14/12/2015 at 07:55 Hrs | | | WI :- 1) Dist. Prot. Optd. RI:-1) Distance Relay, R ph Trip, N ph Trip, carrier send 2) 86 optd. |
| 9 | 220 KV Mahalaxmi-Amona Ckt. | 13/12/2015 at 15:40 Hrs | 13/12/2015 at 17:30 Hrs. | WI :- Nil RI:- Nil | WI :- 1) Dist. Prot. Optd. RI:- Zone -I, Distance = 92.7 KM | Ammona end Relay sensed the fault in Z-I. Matter taken up with Goa electricity. |

Observation:-

Due to bursting of R phase CT Bus Bar protection operated at 220 KV Halkarni S/Stn.

Analysis:-

- 1) R ph CT of 220KV Halkarni-Mahalaxmi burst
- 2) 220KV Bus-bar protection operation is in order
- 3) 220KV Halkarni-Mahalaxmi line Distance relay operation is in order.
- 4) All bays 96 bus-bar trip relay & CB operation are in order at local end.
- 5) Tripping of 220 KV Amona-Mahalaxmi line at amona end on distance protection Z-I is not in order

Area affected :-

Halkarni S/Stn. 20 MW; Hemrus Generation 13 MW; Mahalaxmi Generation 5.1 MW.
Total : Generation Loss : 18.1 MW; Load Loss : 20 MW.

Remedial action:-

Distance protection relay settings of 220KV Amona-Mahalaxmi line needs to be revised at amona end

Submitted for favour of information & needful please.

Encl.: SLD

S. Kumbhar
Superintending Engineer
Testing & Commun. Circle, Karad

Copy s.w.rs.to : 1) The Chief Engineer, Trans (O&M) C.O.Mumbai.
2) The Chief Engineer, LD, Kalwa

Copy f.w.cs.to : 1) The Superintending Engineer, WRPC, Mumbai
2) The Superintending Engineer, WRLDQ, Mumbai
3) The Superintending Engineer, EHV (O&M) Circle, Kolhapur

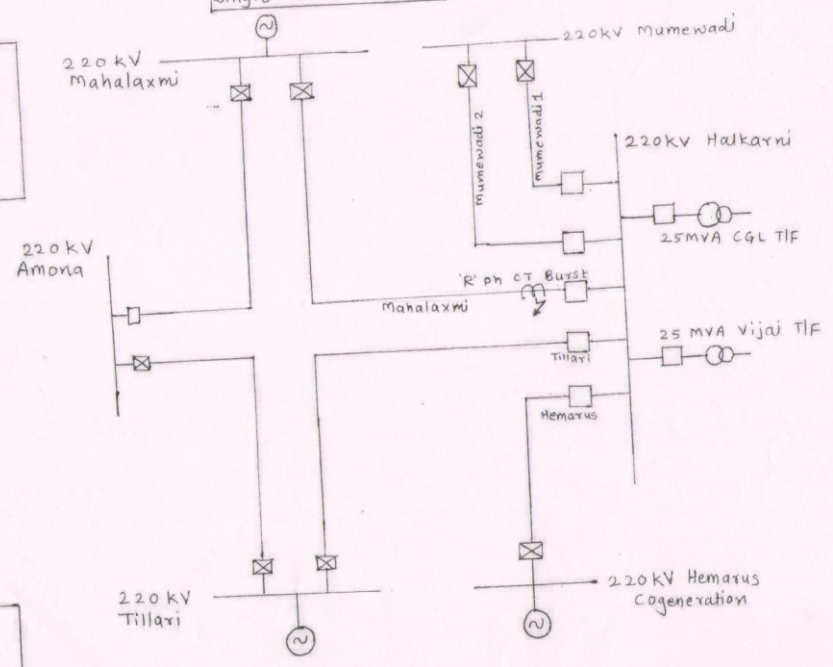
Copy to. The Executive Engineer, Testing Dn., Kolhapur

M/F(T)

Single Line Diagram

220kV Busbar protection operation
 220kV Halkarni station on
 1.13.12.2015

□ → CB open
 ⊗ → CB close



Grid Incidence at 765/400/220 kV Sholapur (PG) and 400/220 kV Kolhapur (MS)

on 26th January 2016

Event Category: GI-2

Event Date and Time: 26th January 2016, 18:00 Hrs

Event Summary: At around 18:00 Hrs, two 400 kV lines from Kolhapur (MS) and two 765 kV lines from Sholapur (PG) Sub-station tripped on overvoltage protection operation. The situation got worsen due to intermittent/non-update of data from 765 kV Sub-station of Powergrid during the period. However, there was no interruption due to this in the system.

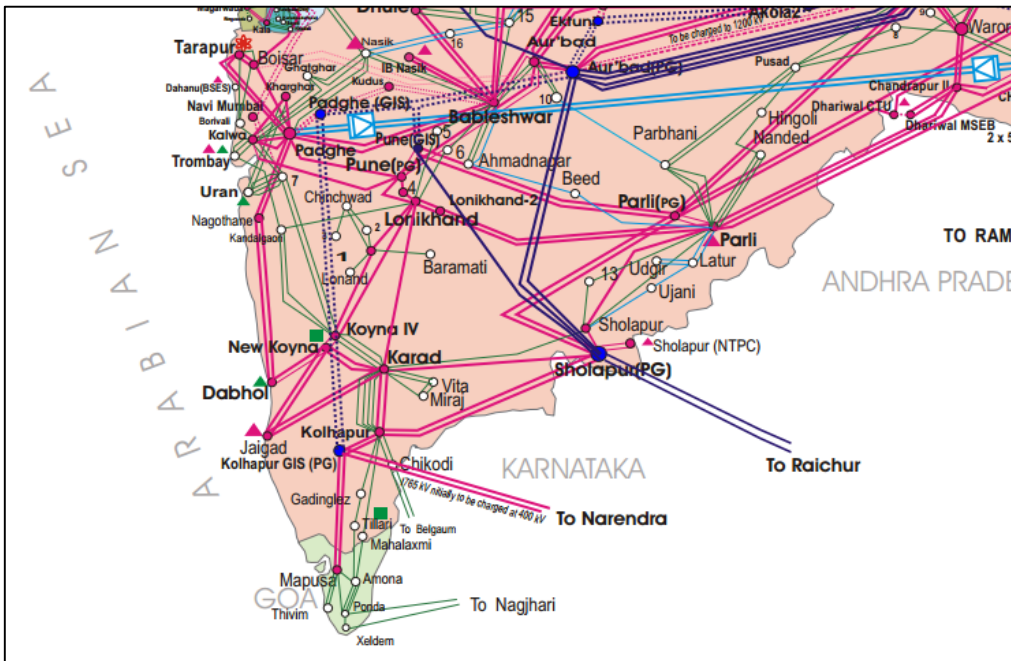


Figure 1 : Geographical Map

Event Overview:

- Due to republic day demand of western region was less compared to other days.

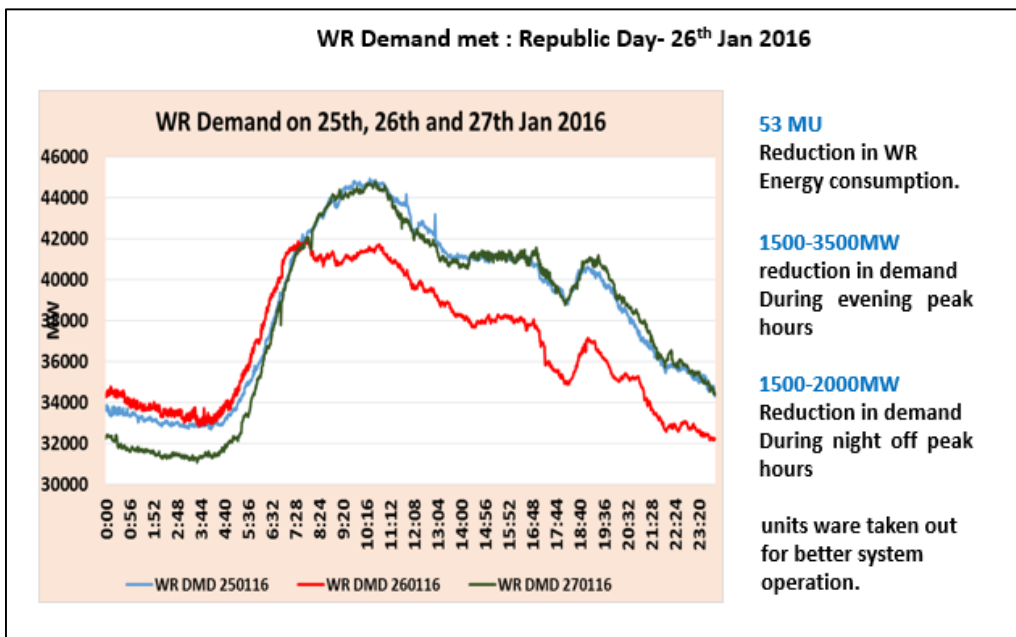


Figure 2 : Geographical Map

- Several of the lightly loaded lines were opened for voltage regulation. The list of line opened is given below.

Table 1 : Line opened to control high voltage.

| Sl.No | Name of line | Voltage level | Utility | Out Time | Out Date | In Date | In time |
|-------|----------------------------------|---------------|----------|----------|----------|----------|---------|
| 1 | Dharamjaygarh(PG)-Jabalpur(PS)-I | 765 kV | PGCIL | 20-01-16 | 20:12 | 31-01-16 | 19:55 |
| 2 | Aurangabad-Wardha-I | 765 kV | PGCIL | 25-01-16 | 17:05 | 28-01-16 | 5:39 |
| 4 | Aurangabad-Wardha-II | 765 kV | PGCIL | 25-01-16 | 20:48 | 27-01-16 | 6:52 |
| 6 | Vadodara(PG)-Dhule(BDTCL) | 765 kV | Sterlite | 26-01-16 | 17:23 | 27-01-16 | 6:36 |
| 8 | CHHEGOAN-JULWANIA S/C | 400 kV | MPPTCL | 16-01-16 | 18:10 | 08-02-16 | 13:40 |
| 9 | KATNI-BIRSINGPUR-II | 400 kV | MPPTCL | 18-01-16 | 4:07 | 30-01-16 | 15:22 |
| 10 | SSP-RAJGARH-I | 400 kV | MPPTCL | 23-01-16 | 13:03 | 03-02-16 | 10:10 |
| 11 | KARAD-JAIGAD-I | 400 kV | MSETCL | 23-01-16 | 16:09 | 27-01-16 | 9:03 |
| 12 | KOSAMBA-CHORANIA -I | 400 kV | GETCO | 23-01-16 | 19:05 | 27-01-16 | 9:37 |
| 13 | KARAD-KOLHAPUR-I | 400 kV | MSETCL | 24-01-16 | 11:13 | 26-01-16 | 17:40 |
| 14 | DHULE-SARDAR SAROVAR-I | 400 kV | MSETCL | 25-01-16 | 13:08 | 27-01-16 | 6:32 |
| 15 | Kolhapur GIS(PG)-Mapusa(PG)-II | 400 kV | PGCIL | 25-01-16 | 16:10 | 27-01-16 | 9:22 |
| 16 | SOLAPUR(PG)-KOLHAPUR-I | 400 kV | PGCIL | 25-01-16 | 16:19 | 27-01-16 | 7:11 |
| 17 | BHUSAWAL-AURANGABAD S/C | 400 kV | MSETCL | 25-01-16 | 17:03 | 27-01-16 | 6:42 |
| 18 | LONIKHAND-KOYNA-IV | 400 kV | MSETCL | 25-01-16 | 18:09 | 26-01-16 | 18:00 |
| 19 | KHANDWA-RAJGARH-I | 400 kV | PGCIL | 25-01-16 | 18:26 | 27-01-16 | 6:03 |
| 20 | Rajgarh(PG)-Kasor(GETCO)-II | 400 kV | RETL | 25-01-16 | 20:53 | 27-01-16 | 7:03 |
| 21 | SOLAPUR(PG)-KARAD-I | 400 kV | MSETCL | 26-01-16 | 17:40 | 27-01-16 | 8:18 |
| 22 | LONIKHAND-KOYNA-IV | 400 kV | MSETCL | 26-01-16 | 18:00 | 27-01-16 | 6:05 |
| 23 | INDIRASAGAR-NAGDA-I | 400 kV | MPPTCL | 26-01-16 | 21:30 | 27-01-16 | 6:52 |
| 24 | ASOJ-CHORANIA-I | 400 kV | GETCO | 26-01-16 | 21:33 | 27-01-16 | 6:30 |
| 25 | CHORANIA-VADAVI-I | 400 kV | GETCO | 26-01-16 | 21:35 | 27-01-16 | 6:20 |
| 26 | KOSAMBA-UKAI-I | 400 kV | GETCO | 26-01-16 | 21:38 | 27-01-16 | 6:30 |
| 27 | KANSARI-VADAVI-II | 400 kV | PGCIL | 26-01-16 | 21:40 | 27-01-16 | 6:05 |
| 28 | SOJA-WANAKBORI-I | 400 kV | GETCO | 26-01-16 | 21:44 | 27-01-16 | 6:37 |

- From 17:00 Hrs to 18:00 Hrs, there was a rapid decline in Western regional demand. However accordingly ramping of generation was also undergoing. So, the underdrawal by the states were less however MP and Maharashtra underdrawal were high on several occasion during the period as can be observed from the deviation plot from figure 3. From figure 4 it can be observed that Frequency has started increasing from 17: 54 Hrs when Maharashtra was overdrawing by 185 MW and MP was underdrawing by 190 MW. It reached to 50.365 HJz at 18:02 Hrs when Maharashtra has went underdrawing (183 MW) from overdrawing entity and P underdrawal has

increased to 320 MW. However such large change in frequency could not be due to these two entities. It was reported by NLDC that during this period Rajasthan has underdrawal of more than 1000 MW causing such frequency excursion at hourly boundary.

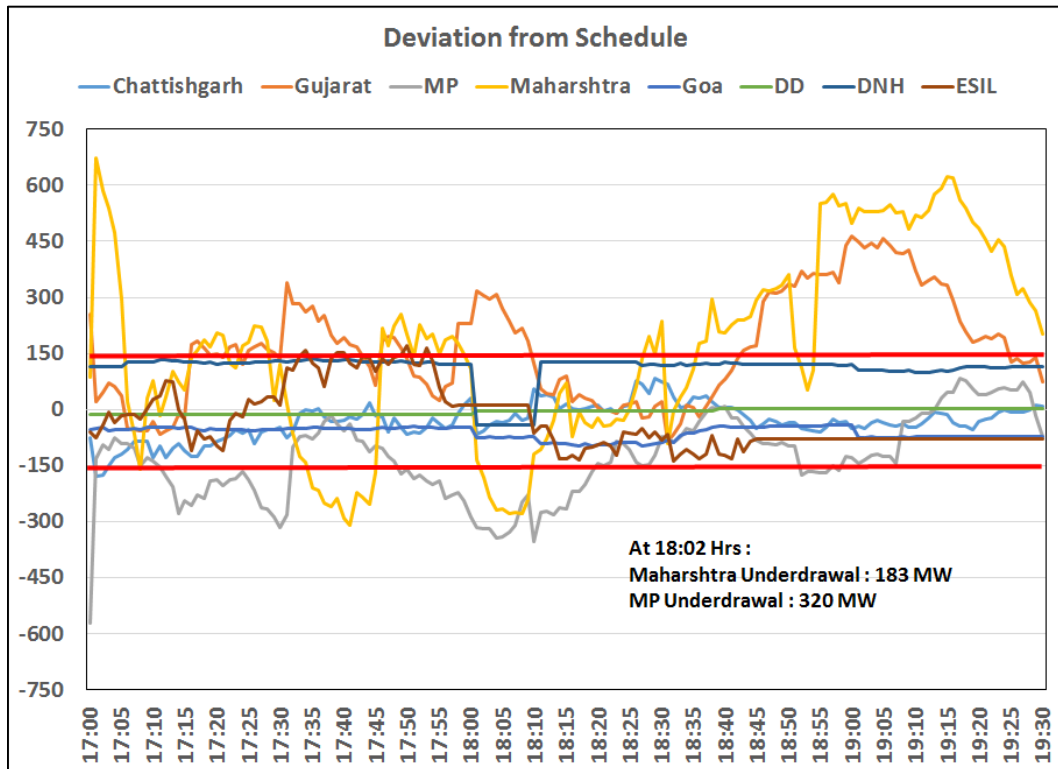


Figure 3 : Deviation from Western region Utility

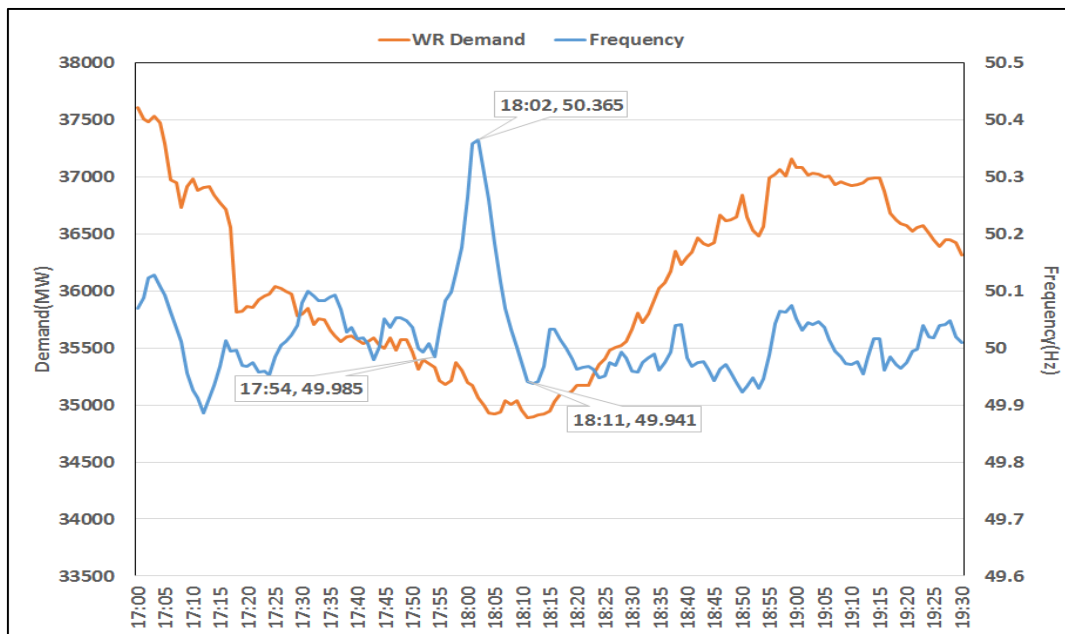


Figure 4 : Western region Demand and Frequency

- The underdrawal in Maharashtra and High frequency resulted in rapid rise of voltage in Southern Maharashtra and Western Maharashtra. This can be observed from voltage plot of 400 kV and 765 kV nodes shown in Figure 5 and 6.

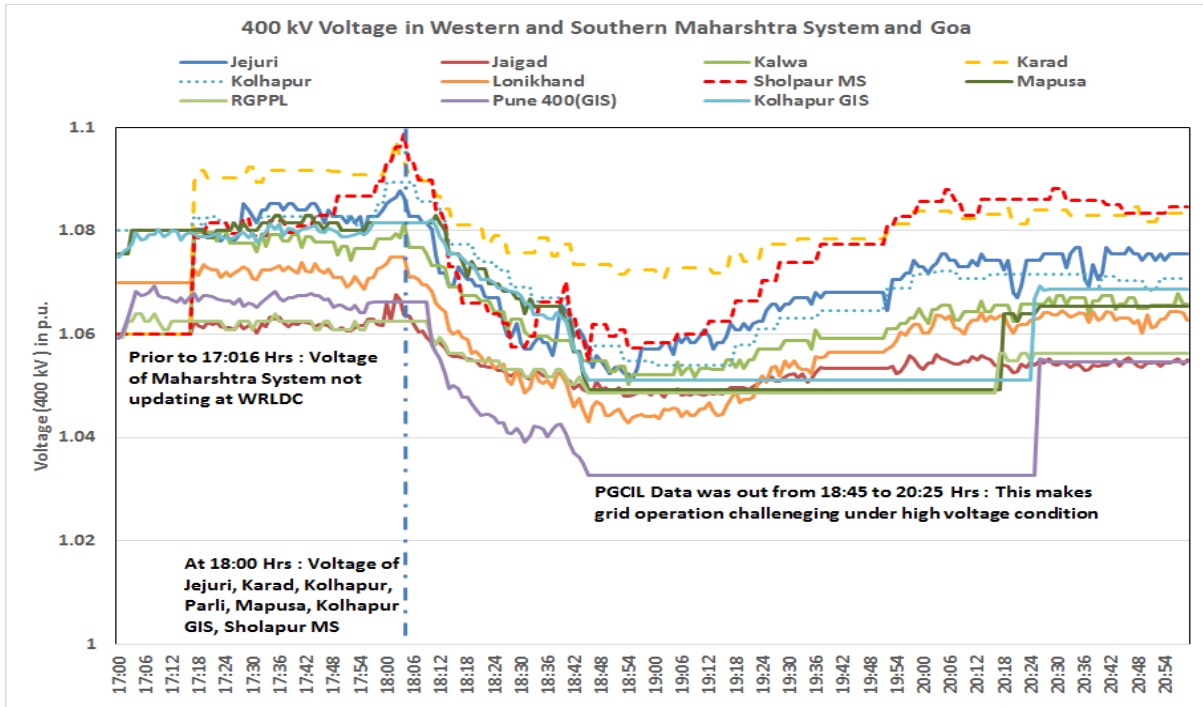


Figure 5 : 400 kV node voltage

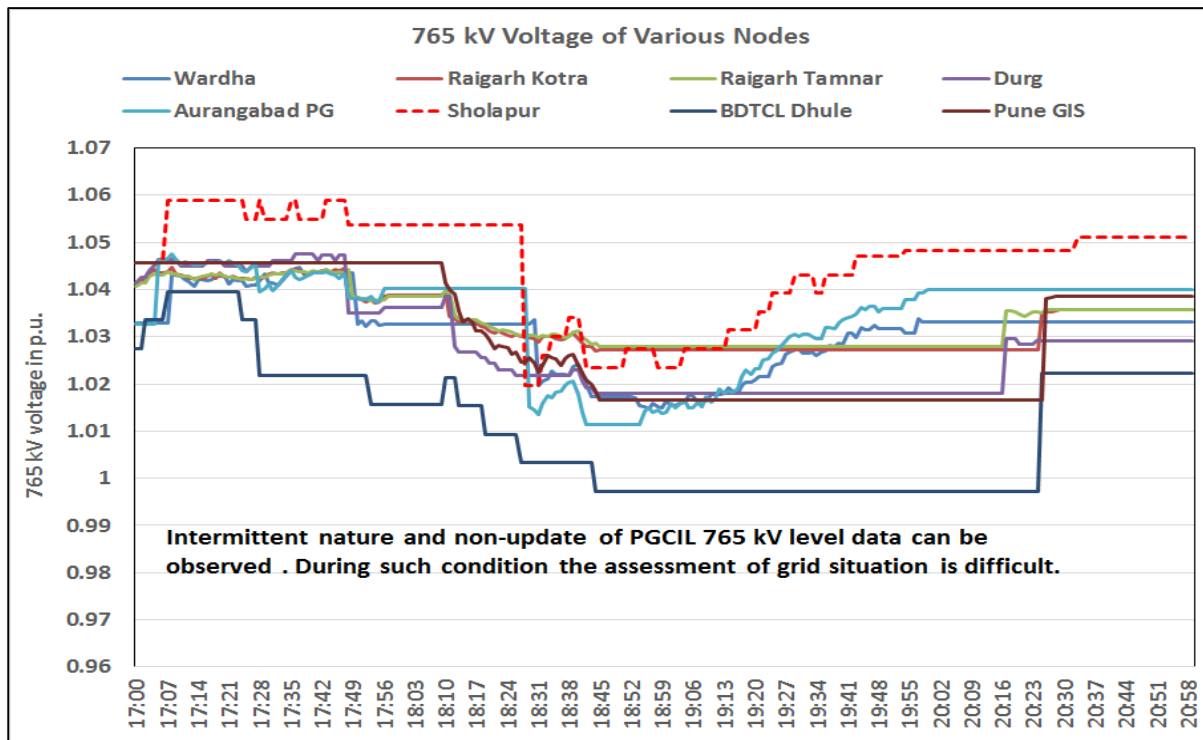


Figure 6 : 765 kV node voltage

- The situation was not good for WRLDC system operator as prior to 17:16 Hrs Maharashtra system voltage data was not available and many of 765 kV voltage data was not updating for PGCIL sub-station. Without these details taking action was difficult for WRLDC operator.
- During the 18:00 Hrs, due to high frequency and Maharashtra underdrawal , the voltage at 400 kV Kolhapur touched 440 kV and 765 kV Sholapur reached above 816 KV. This led to overvoltage

stage 1 pickup of lines at these station. With this, 400 kV Sholapur-Kolhapur 2 and 400 kV Kolhapur-Karad 2 tripped from Kolhapur and 765 kV Pune-Sholapur & 765 kV Sholapur-Aurangabad 1 tripped from Sholapur end. After this voltage has reduced significantly in the system and no further tripping occurred.

- The SOE from 765/400 kV Sholapur sub-station from WRLDC SCADA is given below :

| Element | Sub-Station | Status | Time |
|--------------------|----------------|---------|--------------|
| SOLPR_PARLI2TIE_CB | PGCIL Sholapur | Open | 17:57:48.981 |
| SOLPR_KOLPR-2_CB | PGCIL Sholapur | Open | 17:57:48.977 |
| Sol7_Pune M/B CB | PGCIL Sholapur | Open | 18:00:37.259 |
| Sol7_Pune T/B CB | PGCIL Sholapur | Open | 18:00:37.262 |
| Sol7_Pune M/B CB | PGCIL Sholapur | Open | 18:01:04.000 |
| Sol7_Pune M/B CB | PGCIL Sholapur | Open | 18:01:10.000 |
| Sol7_Argbd1_CB | PGCIL Sholapur | Transit | 18:03:46.869 |
| Sol7_Argbd1_TIE_CB | PGCIL Sholapur | Open | 18:03:46.891 |
| Sol7_Argbd1_CB | PGCIL Sholapur | Open | 18:03:46.892 |
| Sol7_Argbd1_TIE_CB | PGCIL Sholapur | Transit | 18:03:46.869 |

- The Relay indication from DR which are attached as annexure and restoration detail is given in table 2.

Table 2 : Sequence of events

| Elements | Tripping Time | Relay Indication at End 1 | Relay indication at End 2 | Restoration Time |
|-------------------------------------|---------------|---------------------------|---|-------------------|
| 400 kV Sholapur-Kolhapur 2 | 17:57:48.930 | DT Received. | Overvoltage stage 1 trip. No DR from utility | 18:32 |
| 765 kV Pune-Sholapur | 18:00:37.221 | DT Received. | Overvoltage stage 1 trip. VR = 471, VY = 472, VB = 466. DT Sent | 27-01-16 07:04 |
| 400 kV Karad-Kolhapur 2 | 18:00:44.063 | DT Received. | Overvoltage stage 1 trip. No DR from utility | 22:45 |
| 765 kV Aurangabad Sholapur 1 | 18:03:46.849 | DT Received. | Overvoltage stage 1 trip. VR = 471, VY = 477, VB = 467. DT Sent | 18:45 |

* Based on WRLDC SCADA SOE/PMU

Analysis:

- It can be seen that underdrawal accompanied by rapid rate of frequency rise in short duration can result in sudden large variation in voltage in system which can cause overvoltage protection to operate.
- The issue of overvoltage in Western and Southern Maharashtra during off peak hour has been raised on several occasion. The areas need additional reactive compensation in form of Shunt reactors and Dynamic VAR compensation. The bus reactors at Sholapur and Kolhapur which

were planned during the 34th Standing committee in 2012 has not yet materialized even after 3 years and 9 Months. Expected date for these reactors has been given as June 2016 in the 480th OCC meeting of Western region. Most the planned reactor during the 2012 study has come into service within 1-2 years as observed from the status given and has resulted in controlling the voltage in Madhya Pradesh, Gujarat and Chhattisgarh.

Further, 17 nos. of additional bus reactors were approved in the 34th Standing Committee Meeting held on 9th May 2012.

| S. No. | 400 kV Sub/stn. | Size (MVAR) | Implementing agency | Expected commissioning date |
|--------|-----------------|-------------|---------------------|-----------------------------|
| 1 | Nanded | 125 MVAR | MSETCL | 2014 |
| 2 | Sholapur | 125 MVAR | MSETCL | 2014 |
| 3 | Kolhapur | 125 MVAR | MSETCL | 2014 |
| 4 | Akola | 125 MVAR | MSETCL | 2014 |

Status as given in 480th OCC meeting

| S. No. | 400 kV Sub/stn. | Size (MVAR) | Implementing agency | Expected commissioning date |
|--------|-----------------|-------------|---------------------|-----------------------------|
| 1 | Nanded | 125 MVAR | MSETCL | June – 2016 |
| 2 | Sholapur | 125 MVAR | MSETCL | June – 2016 |
| 3 | Kolhapur | 125 MVAR | MSETCL | June – 2016 |
| 4 | Akola | 125 MVAR | MSETCL | June – 2016 |

- It may be seen that due to high voltage in the area several times such multiple tripping has occurred in past. Even on one occasion, complete blackout has occurred in Southern Maharashtra system on 1st March 2015 due to over-voltage tripping of lines.
- The situation get worsen by the fact of intermittent/non update of data from Maharashtra and Power grid sub-station which was observed in the above case. T

Protection and Operation Related Issues:

| Issues | Protection clause applicable | Agency |
|---|---|--|
| Non-Submission of Preliminary Report from User, STU,CTU,SLDC to RLDC | 1. IEGC 5.9.6.a 2. CEA Grid Standard 12.2 (Applicable for SLDC,ALDC only) | PGCIL WR-1 , CPCC Bhadrawati , MSETCL, Maharashtra SLDC (no preliminary report sent to WRLDC for Three line tripping from Sholapur, No report from Kolhapur) |
| DR/EL not provided within 24 Hours | 1. IEGC 5.2 (r) 2. CEA grid Standard 15.3 | MSETCL, PGCIL WR-1 |
| Non-Submission of Details for the tripping which is required for appropriate analysis for GD/GI | 1. IEGC 5.2 (r), 5.9.6.c (VI) 2. CEA grid Standard 15.3 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007-6. 4.d | MSETCL (No DR submitted from Kolhapur) |

| | | |
|---|--|--------------------------------------|
| SCADA data Non-Availability for the station | 1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q | MSETCL, Maharashtra SLDC, PGCIL WR-1 |
|---|--|--------------------------------------|

Recommendation:

- The issue of overvoltage in Southern and Western Maharashtra is persisting since long time. **MSETCL is advised to commission the planned 125 MVAR Bus reactors at Kolhapur and Sholapur in the given timeline.**
- The non-availability of SCADA data is also one issue that WRLDC operator has been facing for Maharashtra system since long time. **Maharashtra SLDC and MSETCL may kindly resolve such issues in least possible time.** For the same 9.4 point of http://www.wrpc.gov.in/occ/480OCC_MINUTE.pdf may kindly referred.
- The issue of loss of /intermittent telemetry from 765 kV Aurangabad, Pune and Sholapur is also a major concern for system operator. For the same Point 9.10 of http://www.wrpc.gov.in/occ/480OCC_MINUTE.pdf may kindly be referred. **PGCIL WR-1 is advised to take immediate action the same.**
- Further both MSETCL and PGCIL WR-1 is advised for sending of DR/EL within 24 Hours to WRLDC/WRPC as per the IEGC 5.2.r and CEA grid standard 15.3.

Annexure: DR from Sholapur (PG) and Karad

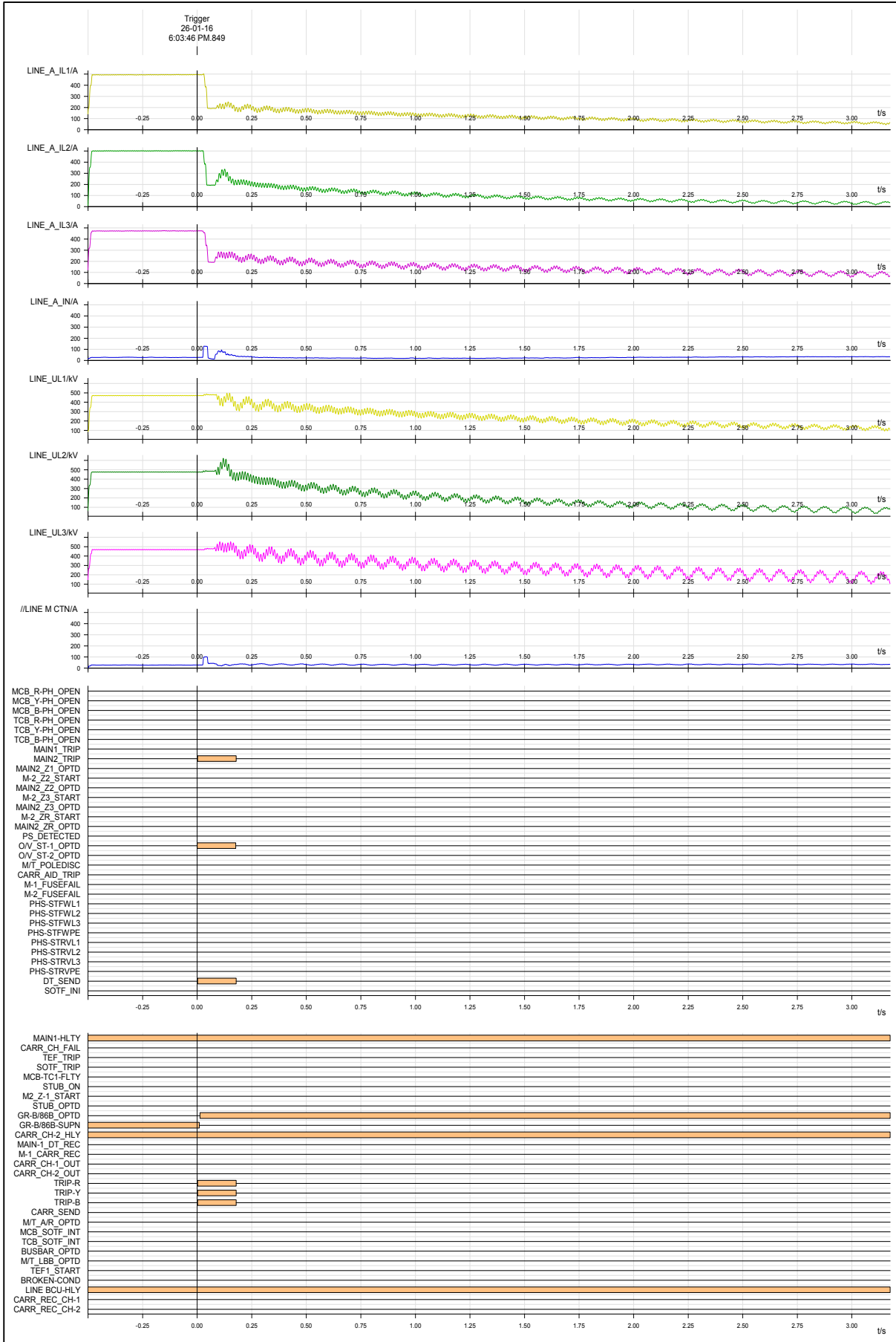


Fig: DR of 765 kV Aurangabad -Solpaur 1 from Solapur end.

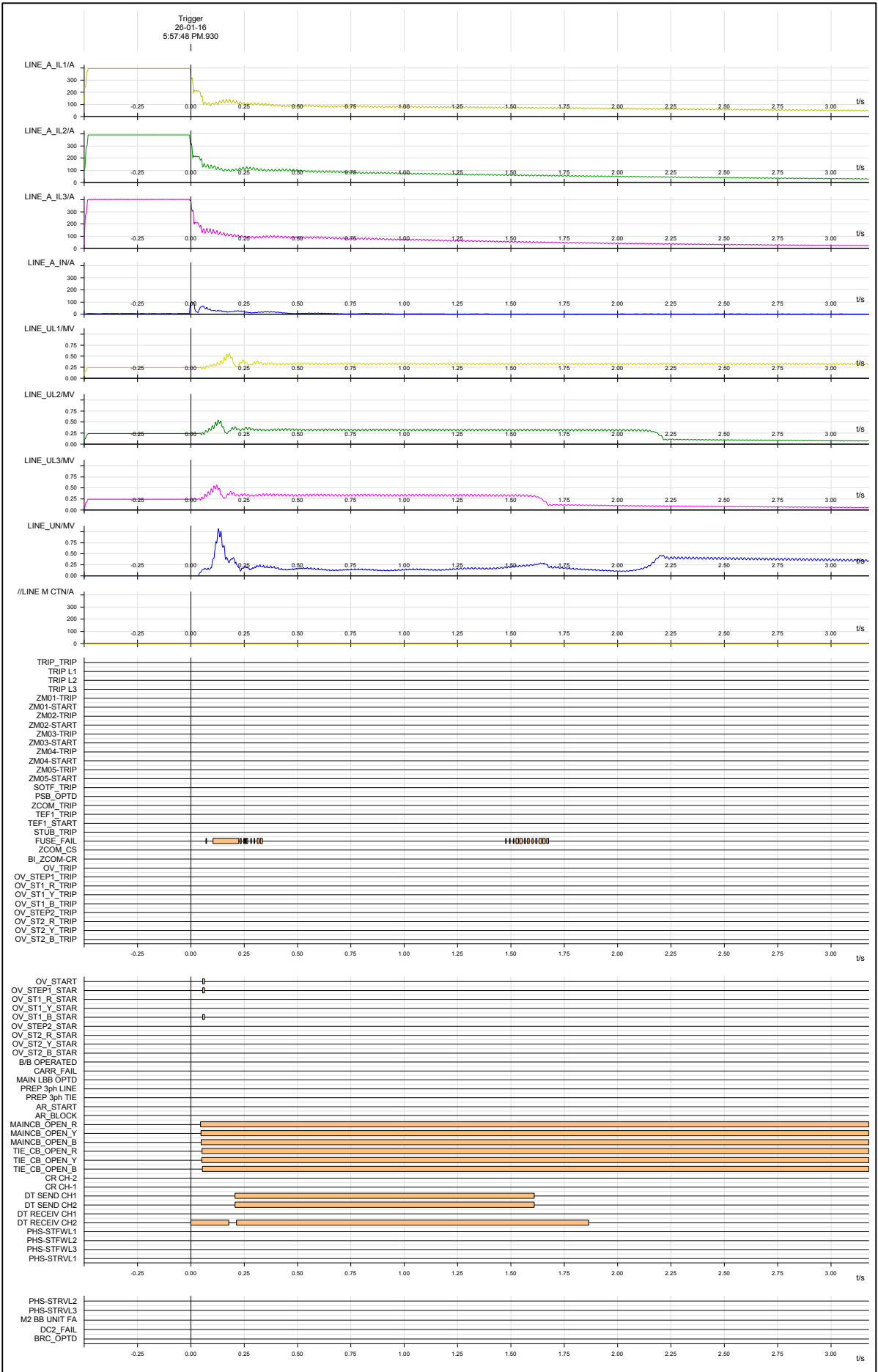


Fig: DR of 400 kV Sholapur-Kolhapur 2 from Solapur end.

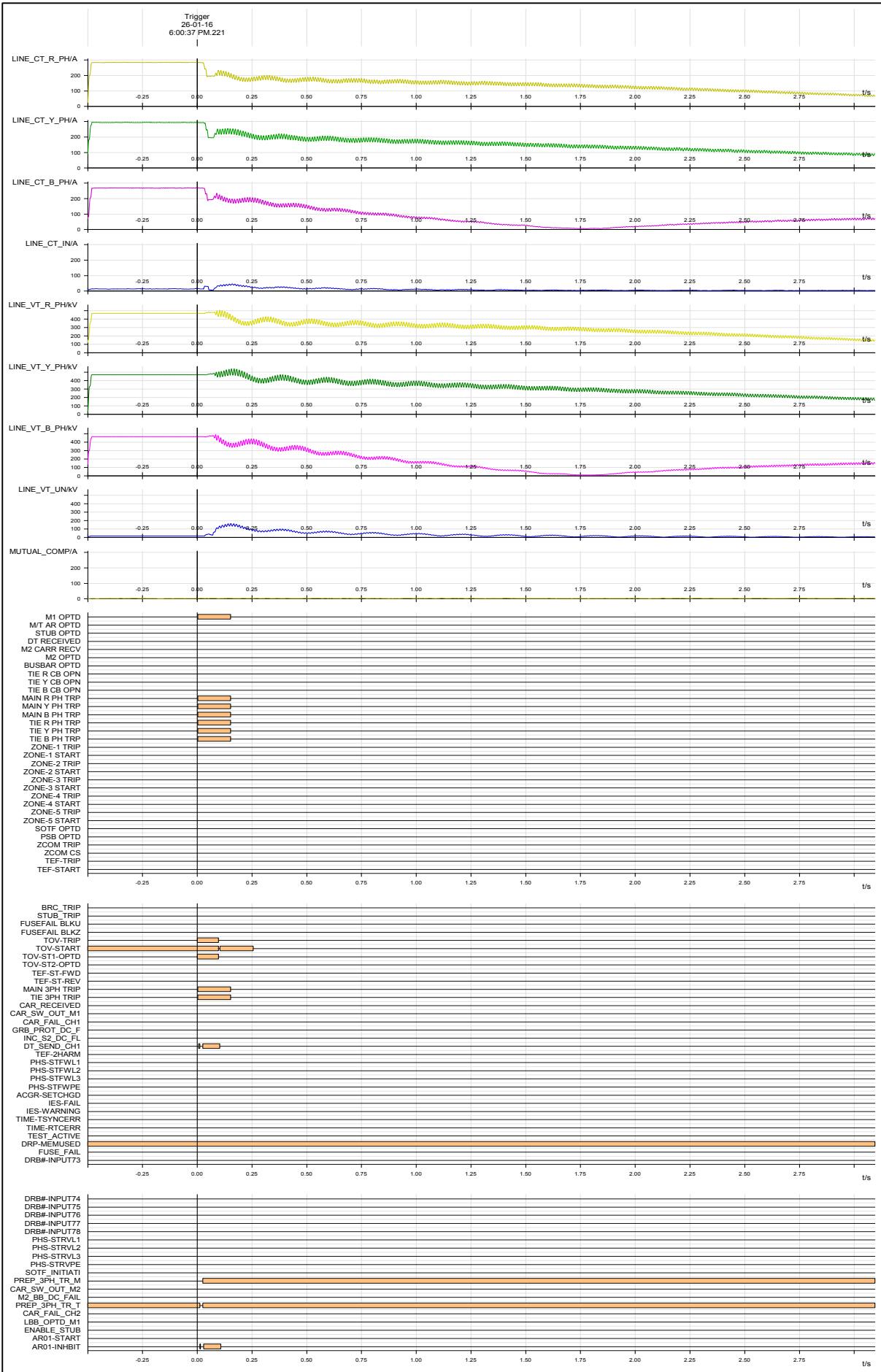


Fig: DR of 400 kV Pune-Sholapur from Solapur end.

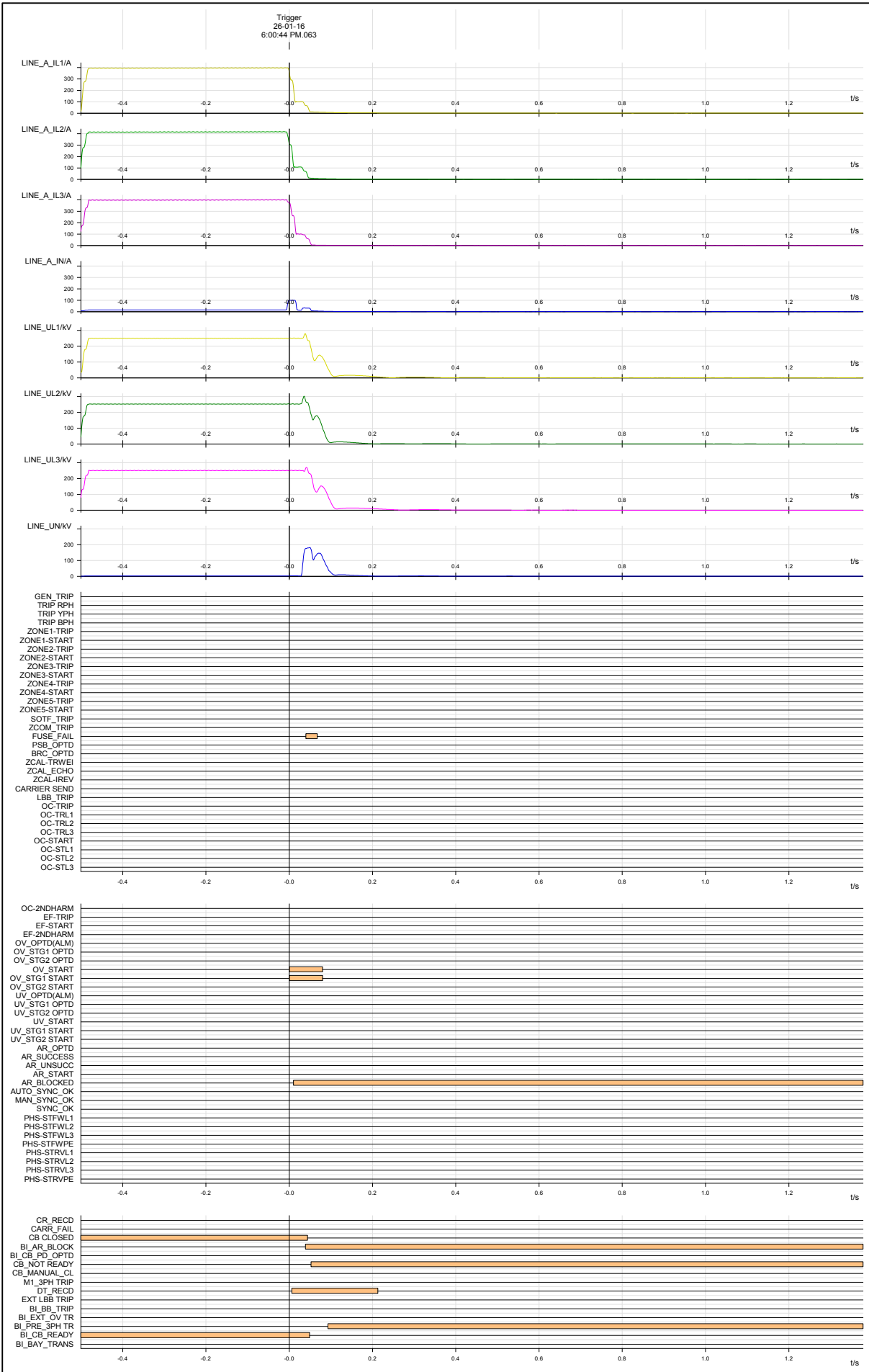


Fig: DR of 400 kV Karad-Kolhapur 2 from Kolhapur end.

Grid Incidence at 765 kV Wardha, Aurangabad, Sholapur and Pune on 28th December 2015

Event Category: GI-2

Event Date and Time: 28th December 2015, 19:45 Hrs.

Event Summary: While opening of 765 kV Wardha-Aurangabad 1 at 19:45 Hrs, simultaneous tripping of 765 kV Wardha-Aurangabad 2 and 765 kV Pune-Sholapur occurred on over-voltage protection operation. This led to single circuit operation between 765 kV Buses of Wardha and Aurangabad as 765 kV Wardha-Aurangabad 3 was kept out on high voltage control. The remaining 765 KV Aurangabad-Wardha 4 was carrying more than 1800 MW during the period. Immediately steps were taken to take 765 kV Wardha-Aurangabad 2 and in order to facilitate its charging 765 kV Durg-Wardha 1 and 765 kV Seoni-Wardha 1 were opened.

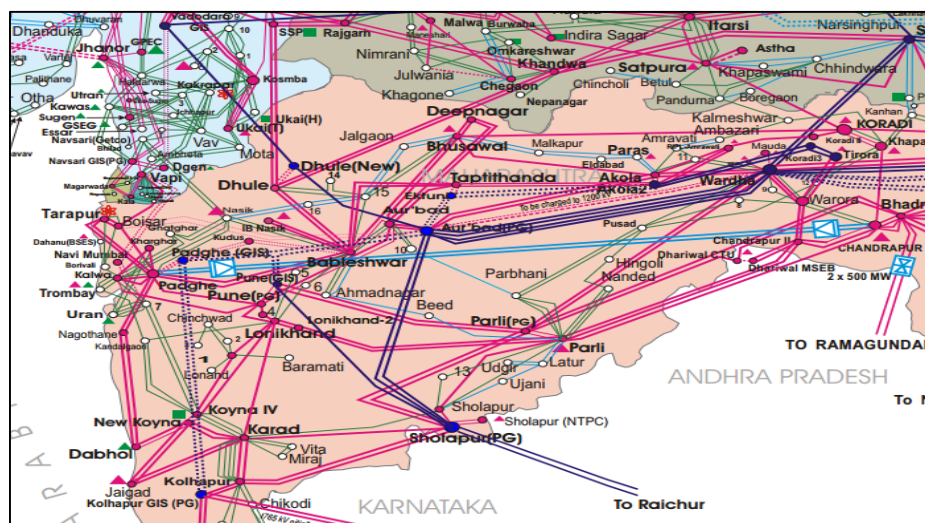


Figure 1 : Geographical Map

Event Overview:

- Prior to the event, system was experiencing high voltage during evening hours. Several lines were kept open on high voltage including 765 kV Aurangabad-Wardha 3.
- In order to control the situation, 765 kV Wardha-Aurangabad 2 was being opened from Wardha end. While opening of the same, 765 kV Wardha-Aurangabad 1 and 765 kV Pune-Sholapur circuit also tripped on over-voltage. The sequence of event from WRLDC SCADA is given below.

| Time | Station | Event |
|--------------|---------|-------------------------------------|
| 19:44:48.684 | Wardha | Wardha-A'bad 1 Tie CB open |
| 19:44:58.097 | Wardha | Wardha-A'Bad 1 Main CB close |
| 19:44:59.195 | A'Bad | Wardha-A'bad 1 Main CB open |
| 19:44:59.199 | A'Bad | Wardha-A'bad 1 Tie CB open |
| 19:44:59.254 | Wardha | Wardha-A'Bad 1 Main CB open |
| 19:45:04.206 | Solapur | Solapur-Pune Main and Tie Cb open |
| 19:45:05.206 | A'bad | A'bad-Wardha 2 Main and Tie CB open |
| 19:45:05.272 | Wardha | A'bad-Wardha 2 Main and Tie CB open |

- Based on the DR for 765 kV Wardha-A'Bad 1 and 2 and 765 kV Pune-Solapur, it is observed that when the 765 kV Wardha-Aurangabad 1 was being opened the relay at Aurangabad for 765 kV

Aurangabad-Sholapur 1 & 2 and relay at Sholapur for 765 kV Sholapur-Pune end has already picked up for overvoltage. However, even after tripping of 765 kV Wardha-A'bad 1 (DT send from Wardha to A'bad end) and voltage reduction of 7 kV at Aurangabad, the relay have not got reset and operated as per their setting. The relay at Aurangabad is MICOM which did not get reset due to low drop off to pick up ration of 95 %.

- DR for the event are attached as annexure. The voltage and line loading plot are given in figure 2 and 3. It can be observed that prior to the event, the voltage at Sholapur, Aurangabad, Dhule BDTCL, Wardha and Durg were high. After the tripping voltage has reduced and no further tripping occurred. After the tripping there was only one circuit between 765 kV Wardha and Aurangabad which was circuit 4 and it was carrying around 1800 MW.

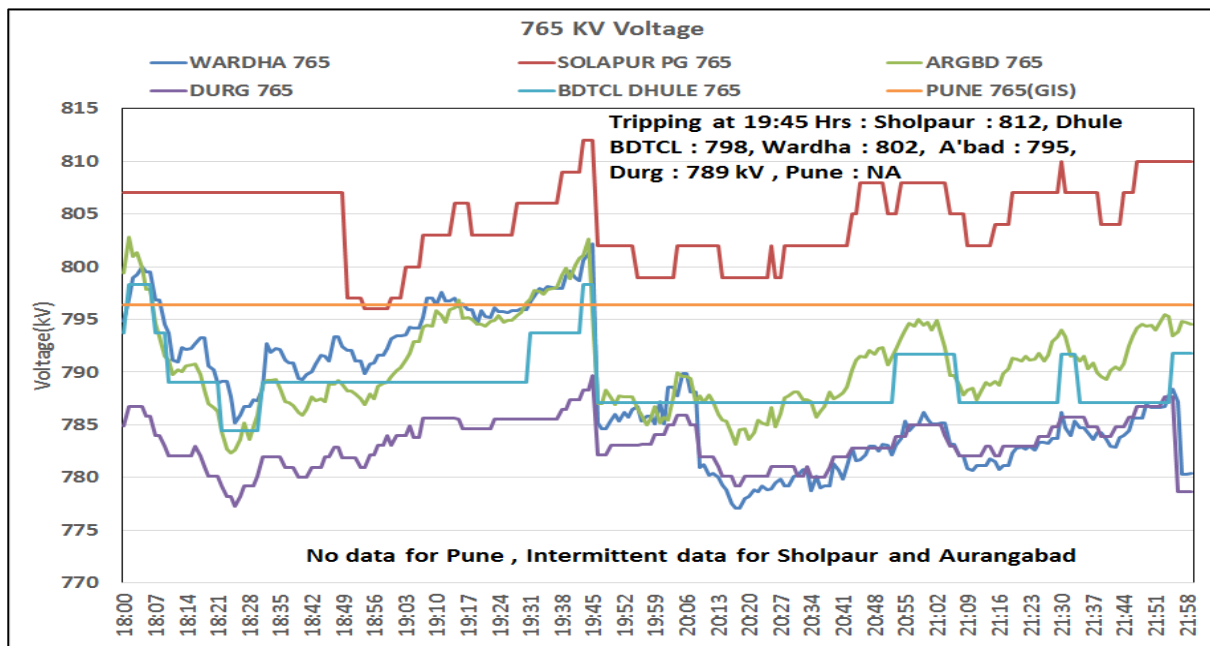


Figure 2 : 765 kV Bus Voltages

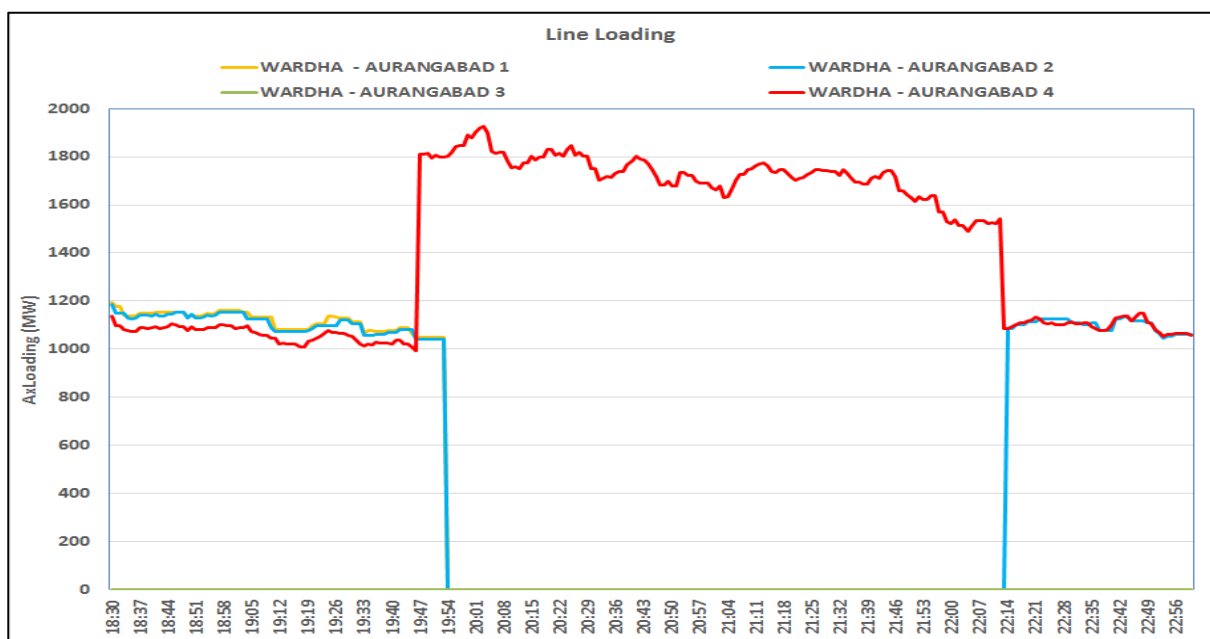


Figure 3 : 765 kV Aurangabd-Wardha 1, 2, 3 & 4 Line loading.

Table 1 : Sequence of events

| Elements | Tripping Time | Relay Indication at End 1 | Relay indication at End 2 | Restoration Time |
|----------------------------|---------------|---------------------------|--|-------------------|
| 765 kV Wardha-Aurangabad 1 | 19:44:59.163 | Hand tripped | DT received | 29-12-15 07:26 |
| 765 kV Wardha-Aurangabad 2 | 19:45:05.161 | DT received. | Overvoltage stage 1 optd. Main 1 relay operated. | 22:1 2 |
| 765 kV Pune-Sholapur | 19:45:04.241 | Dt received | Overvoltage stage 1 optd. No DR send by PGCIL Sholapur | 29-12-15 08:04 |

* Based on WRLDC SCADA SOE/PMU

In order to facilitate the charging of one of the circuit, voltage has to be reduced at Wardha and Aurangabad and for the same 765 kV Durg-Wardha 1 and 765 kV Seoni-Wardha 1 were opened at 21:54 and 22:08 Hrs respectively.

Recommendation:

- As seen from the analysis, the reason for the tripping of other circuit were low drop off to pick up ratio at Aurangabad and Sholpaur end. These relay if were having 99 % drop off to pick up ratio, then such multiple tripping could have been avoided. **In view of the same it is suggested that separate overvoltage relay may be put in place in order to avoid such tripping at High voltage nodes like Sholapur, Wardha and Aurangabad whose drop off to pick up ratio is 98-99 %.**
- Further issue of additional reactive compensation requirement at 765 kV Wardha, Aurangabad and Sholpaur has been raised in 39th WR standing committee and Operational feedback to CEA /CTU.

Annexure:

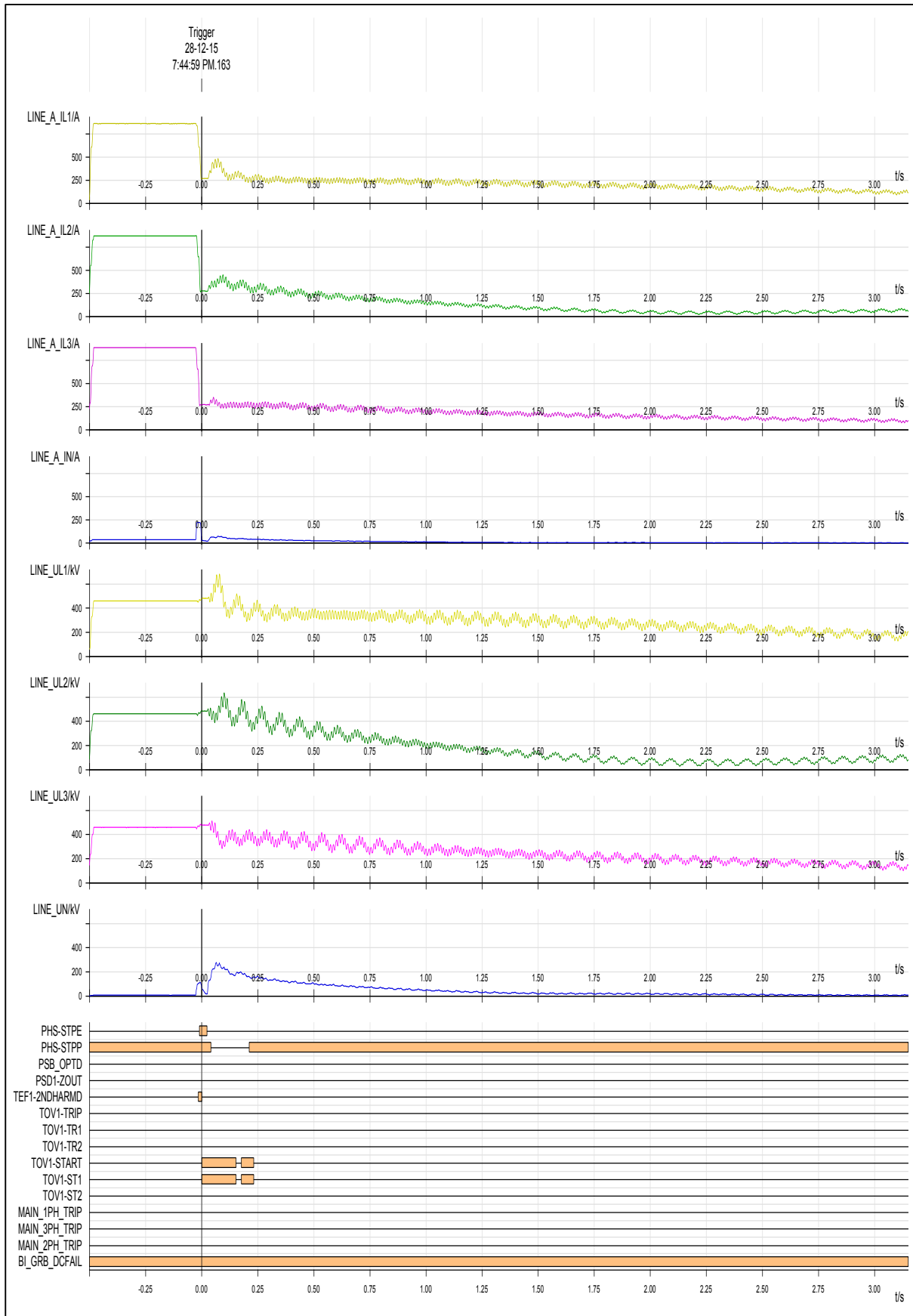


Fig: DR of 765 kV Wardha-Aurangabad 1 from Wardha end. Line was being hand tripped from Wardha end. It can be observed that due to switching overvoltage after breaker opening, over voltage has picked up by the relay. (Prior to tripping VR=460 kV VY=463 kV VB=459 kV)

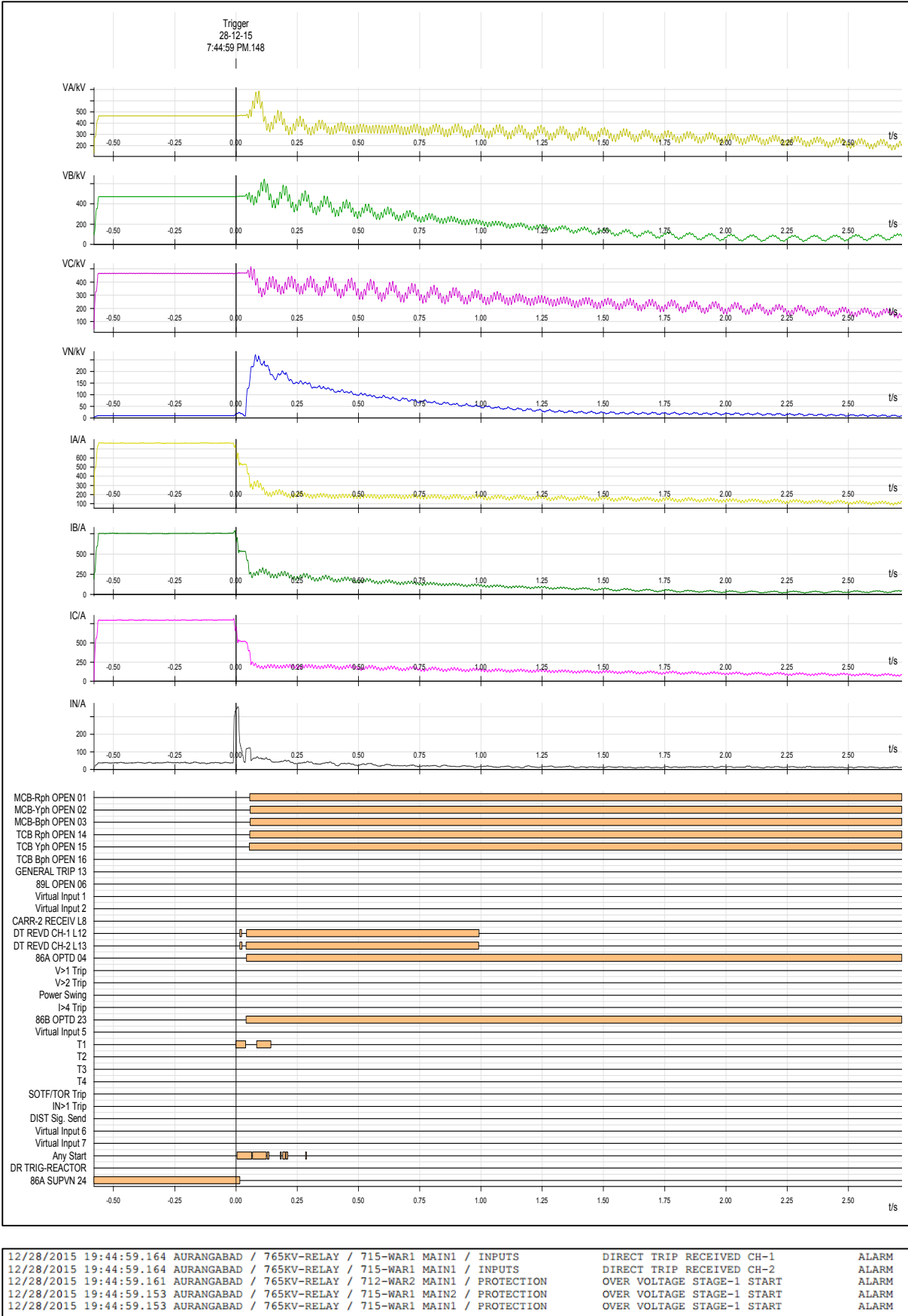


Fig: DR and EL of 765 kV Wardha-Aurangabad 1 from Aurangabad end. Line was being hand tripped from Wardha end and DT received at Aurangabad end. EL shows that Overvoltage has picked up in relay at 1:44:59.153 as soon as this line got opened at Wardha end at 19:44:59.144. Line has tripped on DT received at 19:44:59.164. (Prior to tripping VR=466 kV VY=471 kV VB=465 kV)

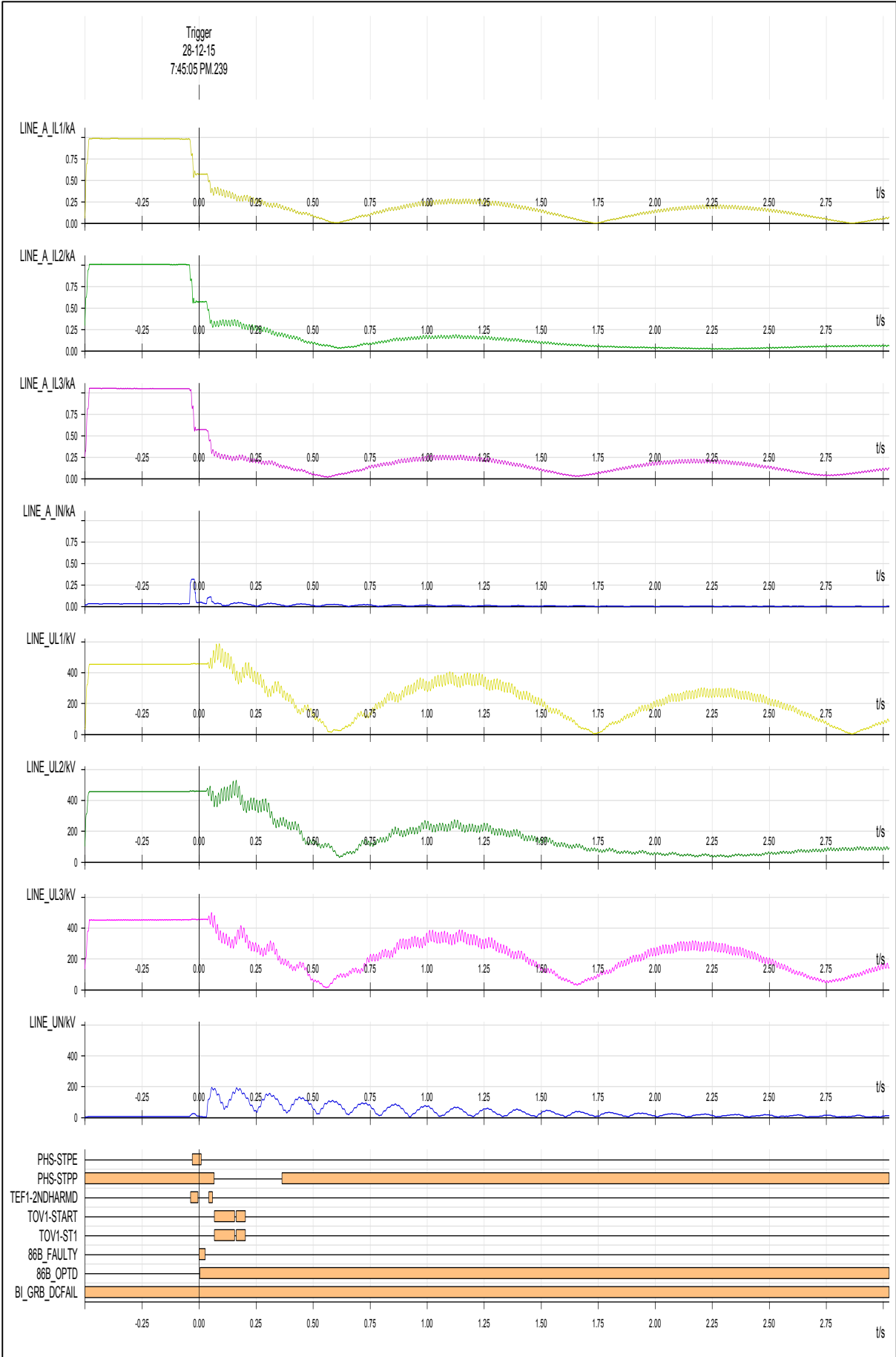
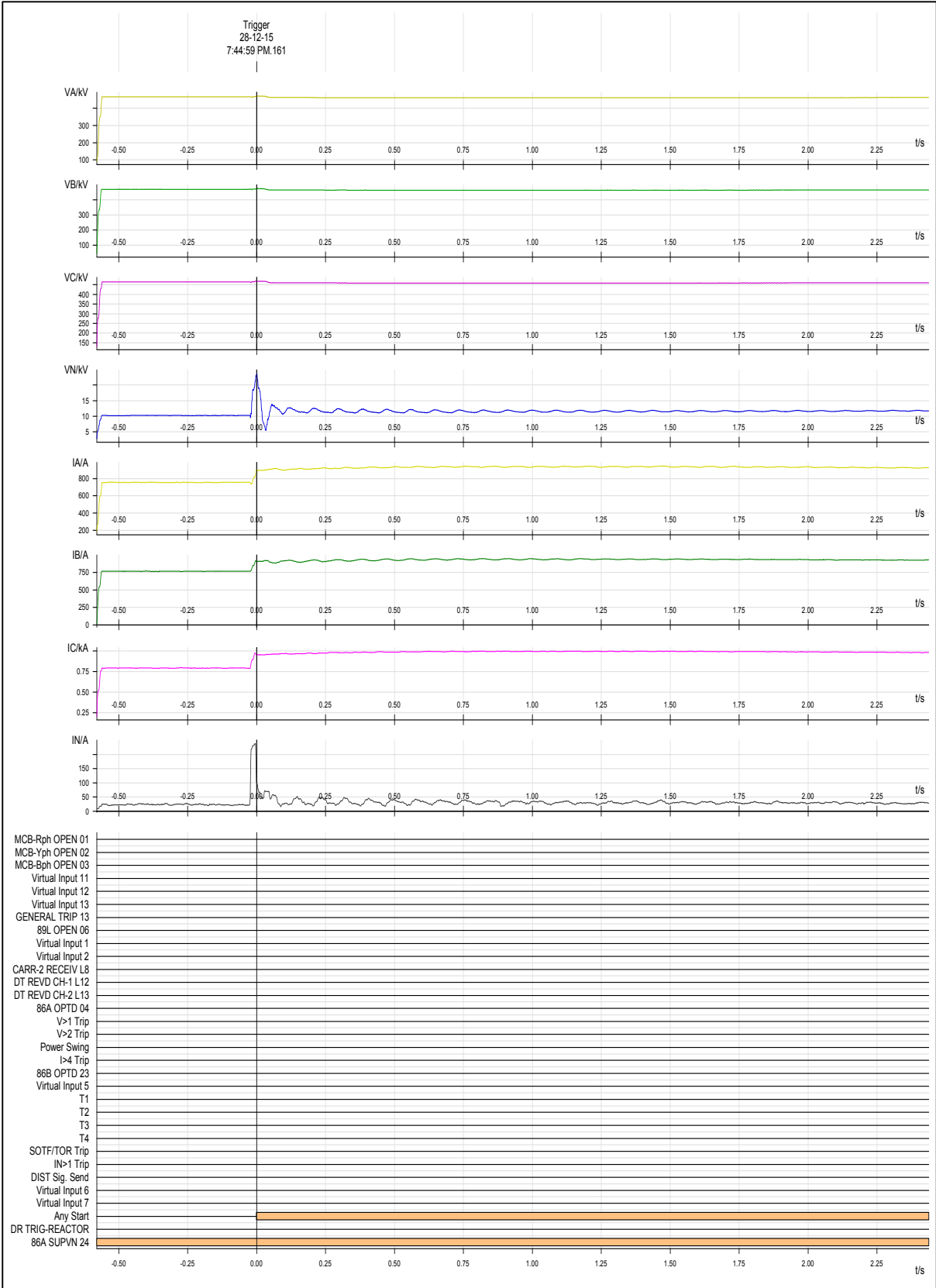


Fig: DR of 765 kV Wardha-Aurangabad 2 from Wardha end. Line tripped on DT received from Aurangabad end at 19:45:05.239.



| | | | |
|-------------------------|--|----------------------------|-------|
| 12/28/2015 19:44:59.161 | AURANGABAD / 765KV-RELAY / 712-WAR2 MAIN1 / PROTECTION | OVER VOLTAGE STAGE-1 START | ALARM |
| 12/28/2015 19:44:59.153 | AURANGABAD / 765KV-RELAY / 715-WAR1 MAIN2 / PROTECTION | OVER VOLTAGE STAGE-1 START | ALARM |
| 12/28/2015 19:44:59.153 | AURANGABAD / 765KV-RELAY / 715-WAR1 MAIN1 / PROTECTION | OVER VOLTAGE STAGE-1 START | ALARM |

Fig: DR and EL of 765 kV Wardha-Aurangabad 2 from Aurangabad end. EL shows that Main 2 relay at Aurangabad end has pickup up overvoltage stage 1 at 19:44.59.161. It did not get reset even after tripping of 765 kV Aurangabad-Wardha 1 tripping at 19:44.59.163 from A'bad end.

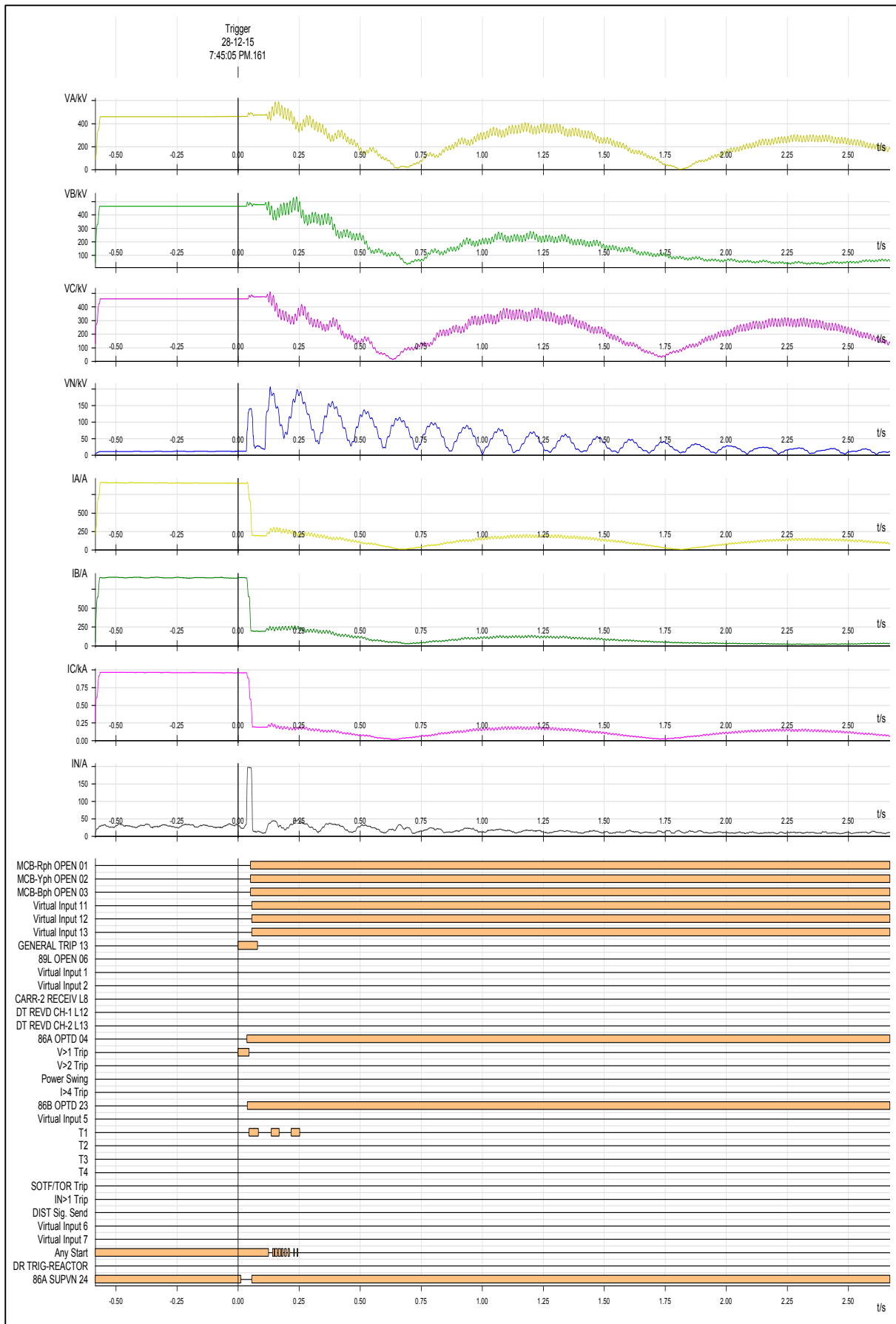


Fig: DR and EL of 765 kV Wardha-Aurangabad 2 from Aurangabad end at the time of tripping at 19:45:05.161. The line tripped on overvoltage on Main 1 protection trip command. (Prior to tripping VR=461 kV VY=465 kV VB=460 kV)

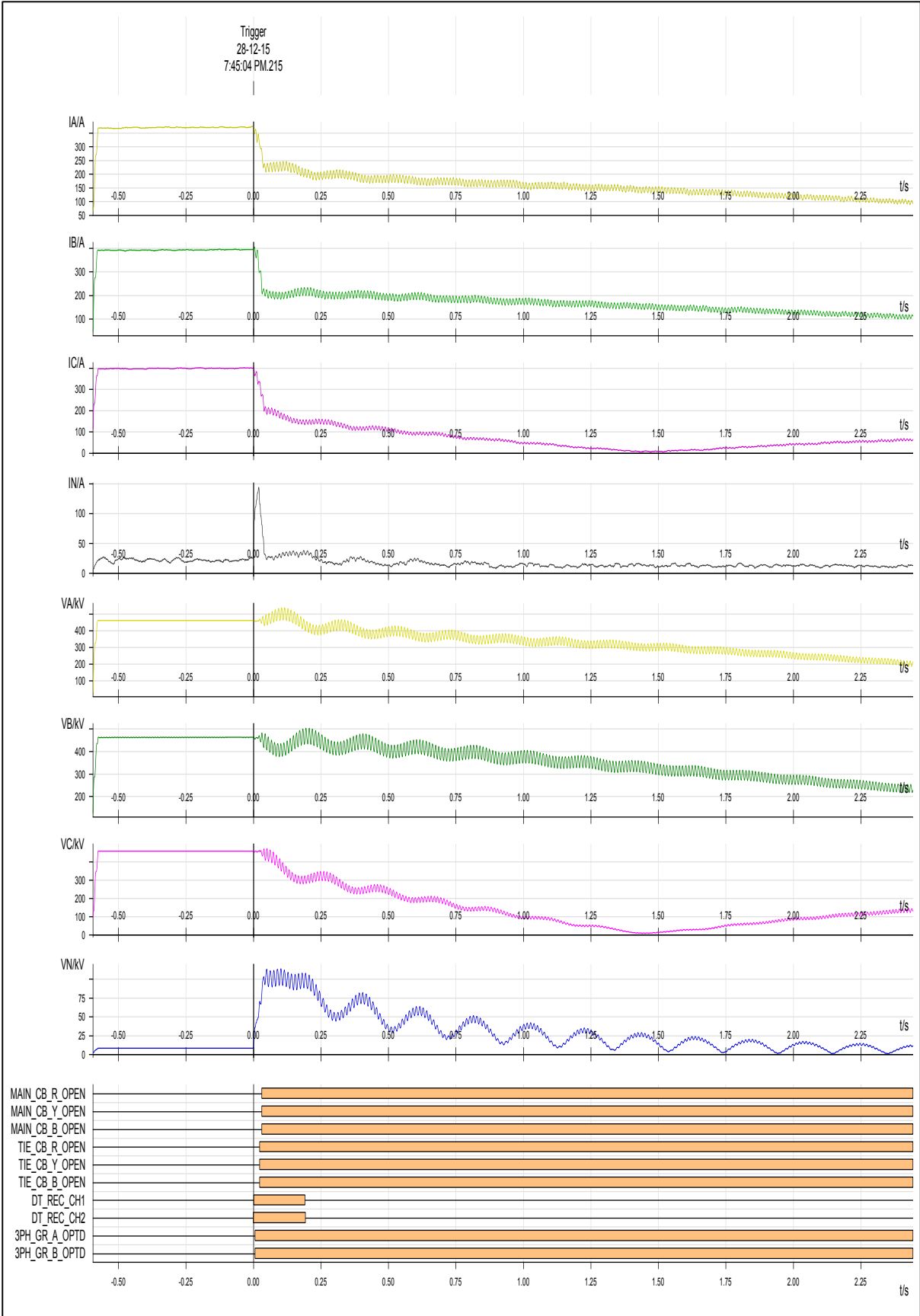


Fig: DR and EL of 765 kV Pune-Sholapur from Sholpaur end at the time of tripping at 19:45:04.241. The line tripped on overvoltage protection trip command at Sholapur and DT was send to Pune end. (Prior to tripping voltage at Pune end VR=461 kV VY=463 kV VB=458 kV)

Annexure: Report from MSETCL


MAHA TRANSCO

Maharashtra State Electricity Transmission Co. Ltd.

MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO.LTD.

| | |
|--|--|
| From: Name of Office: Superintending Engineer Office address: Testing & communication circle Block No.12 MSETCL Admin Bldg. Racca Plot, Old Saykheda Road, Jail Road, Nashik (422101) Contact No: 2403181 Email Id: se5500@mahatransco.in | To, The Chief Engineer, Trans O&M, MSETCL, C.O. Mumbai. |
|--|--|

Ref. No. SE/TCC/NSK/T/No. 243

Date: 12-01-16

Sub.-: Occurrence report of operation of 400kV BB protection at 400 KV R/S Khadka at 18:31Hrs on dt-30.12.2015.

On dated 30.12.2015 at 18:29 Hrs 400KV Khadka- A'bad circuit hand tripped for system constraint but Y ph CB pole not opened and resulted into bursting due to this IPS tube fallen down in switch yard. This resulted into operation of Bus Bar Protection for zone 2 (Bus-II). The detail indications are as Relay Indications of 400KV Bus Bar Panel-

| BB2 Panel | BB3 Panel | BB4 Panel |
|-----------------|--|-------------------------|
| S & U Flag optd | Koradi- 96optd A'bad- 96 optd B/C- 96 optd ICT II - 96 optd Deepnagar -I - 96 optd | B/B protn optd- Zone-II |

A) 400kV Khadka-Aurangabad Line

| 400kV Khadka End | | | 400kV Aurangabad End | |
|----------------------------------|--|--|--|--|
| WI | Main-1 Protection | Main -2 Panel | WI | RI |
| 1. Low SF6 gas pressure alarm | Disturbance-1 Time:18:26:56:414 Trig signal: U3< | Disturbance-1 Time: 18:27:22:682 Trig signal – DT send | Main I protection optd. | 186 -3 optd 286 – 3 optd |
| 2. Low SF6 gas pressure lockout, | Carrier healthy AR CB Ready AR PREP 1PHT | MCB Closed H/T | Main II protection optd. | 85 LO – DT received |
| 3. Bus bar Protn operated, | Disturbance-2 Time: | DT send Disturbance-2 | Trip ckt- 2 faulty direct carrier failed | 186 A,B,C group A 286 A,B,C group B |
| 4. Trip ckt I faulty, | 18:28:01:347 Trig signal: Bus bar optd | Time: : 18:28:27:671 | | 85-lo ch-2 |
| 5. Trip ckt II faulty, | DT send | Trigsignal: Bus bar trip | | |
| 6. Low air pressure alarm, | Bus bar optd | A/R CB ready DT send | | |
| 7. Low air pressure Lockout, | | | | |

B) 400kV Khadka-Koradi Line

| 400kV Khadka End | | | 400kV Koradi End | |
|------------------|---|--|--|--|
| | Main-1 Protection | Main-2 Protection | WI | RI |
| Busbar optd | Disturbance-1 Time: 18:28:11:104 Trig signal: R ph volt< Bus bar optd DT send Carrier healthy AR CB ready MCB closed AR PREP 1 PHT | Disturbance-1 Time: 18:27:51:785 Trig signal: U2< Bus bar optd DT send Carrier healthy AR CB ready MCB closed AR PREP 1 PHT | Main I Protection Optd. Main II Protection Optd. Lock Out Trip for Remote Fault NSD 50 (M2) Coupler fail | 86A1 optd 86 B1 optd 86A2 optd 86 B2 optd Direct Trip Receive CH-1 Direct Trip received CH-2 Overvoltage Relay optd (Y- ph& B- ph) |

C) 400kV Khadka-Deepnagar-I Line

| 400kV Khadka | | | 400kV Deepnagar-1 | |
|--------------|--------------------|---------------------------------------|--|---|
| | Main-1 Protection | Main-2 Protection | WI (SCADA) | RI |
| NIL | DT send A/R BLK | RI-SPT enable 79 Lock out AR-CB | CSC 101 A/R lock out SEL 421 Carr. RECEIV. A/R lockout DT received BCU | Main – I Panel COX 1 Main–II Panel COX 2 DTX1 DTX2 |

Sequence of operation:

1. On dated 30.12.2015 @ 18:29 Hrs 400KV Khadka- A' bad circuit Hand tripped for system constraint but Y-ph CB pole not opened & resulted into bursting of Y-ph pole of CB due to this IPS tube fallen down. This resulted in to operation of Bus Bar zone-II (CH-II) protection. All 400kV feeders and ICT 2 400/132kV, 200MVA connected to bus II was tripped.
2. Faulty section of 400KV A'bad circuit bay taken out from Bus-II & Bus-II thoroughly checked & same informed to LD Nagpur.
3. Relay & window indication as well as disturbance noted conveyed to L.D.
4. LD permitted for restoration at 19:02 Hrs on dt. 30.12.2015

Observations:

1. Only main SF-6 interrupter has burst. The pole was in erected vertical position with CB flag showing off position.
2. Pitting/rusting is observed on PIR contacts.
3. The connecting rod found broken/sheared position.
4. Grading capacitor didn't catch fire

Analysis:-

The said CB is subjected to close/Open duty almost every day for system voltage control as per LD instructions.

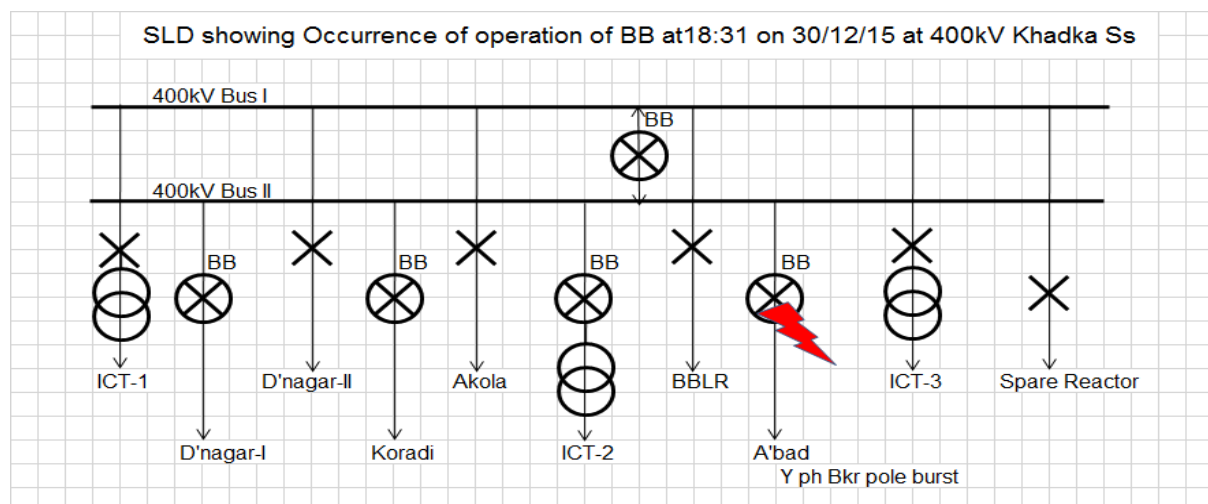
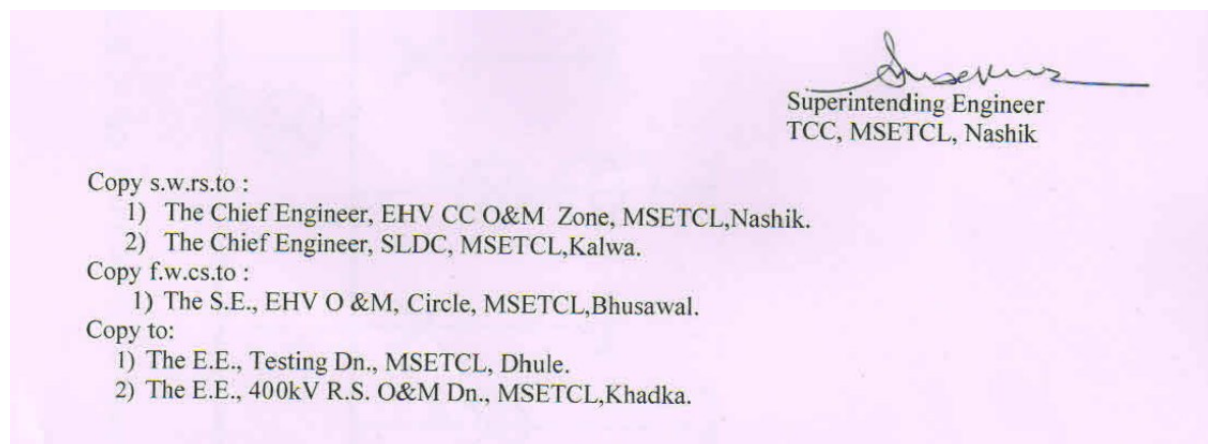
The CB was commissioned in 2005 considering the ageing & frequent ON/OFF operations it is suspected that when the CB was tripped manually on the day of occurrence the connecting rod got broken (Photograph enclosed) & failed to transfer the operating force to the moving contacts resulting incomplete contact separation & the load current does not get interrupted (As seen from DR) fully. This situation persisted for @ 1 min(As noted from event data) and finally resulted in bursting of CB pole.

L.B.T& Restoration:

| Feeder/ICT | Amp/MW | Restoration Time |
|--------------------------|--------------------|---------------------------------------|
| 400kV A'bad | 260Amp,166 MW | 9:10Hrs on 4/1/16 charged through TBC |
| 400kV Koradi | 407Amp, 288MW | 19:13Hrs |
| 400kV Deepnagar-I | 23Amp, 14MW | 19:22Hrs |
| 400/132kV 200MVA - ICT-2 | 52.20Amp, -21.21MW | 19:04Hrs |

Submitted for your kind information please.

Enclosure: (1) SLD (2) Photograph showing broken connecting rod.



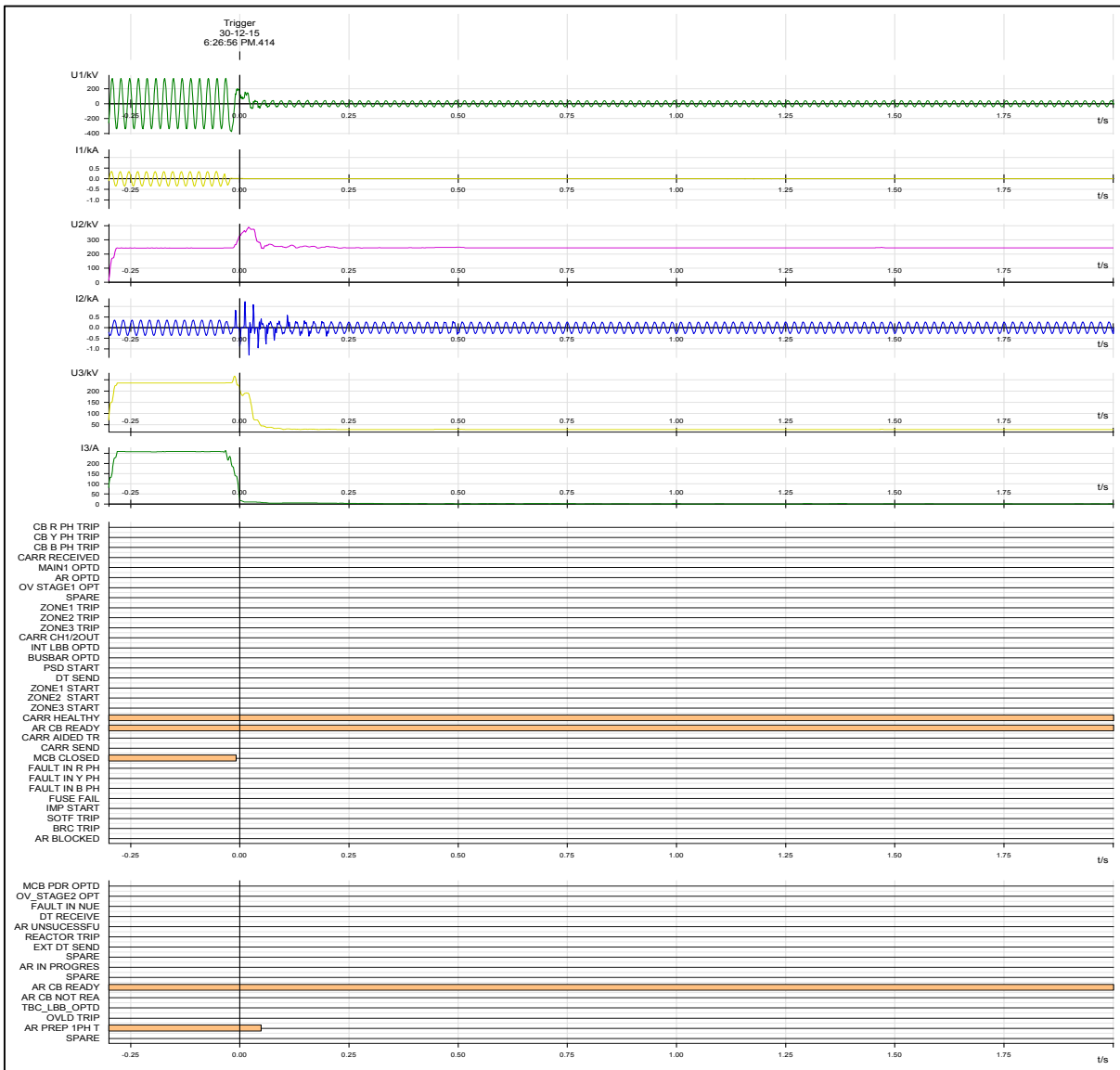
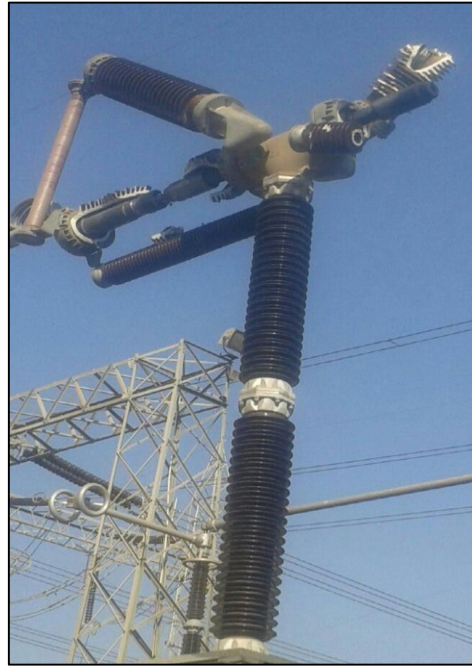


Fig: DR of 400 kV Bhusawal-Aurangabad from Bhusawal end during hand trip

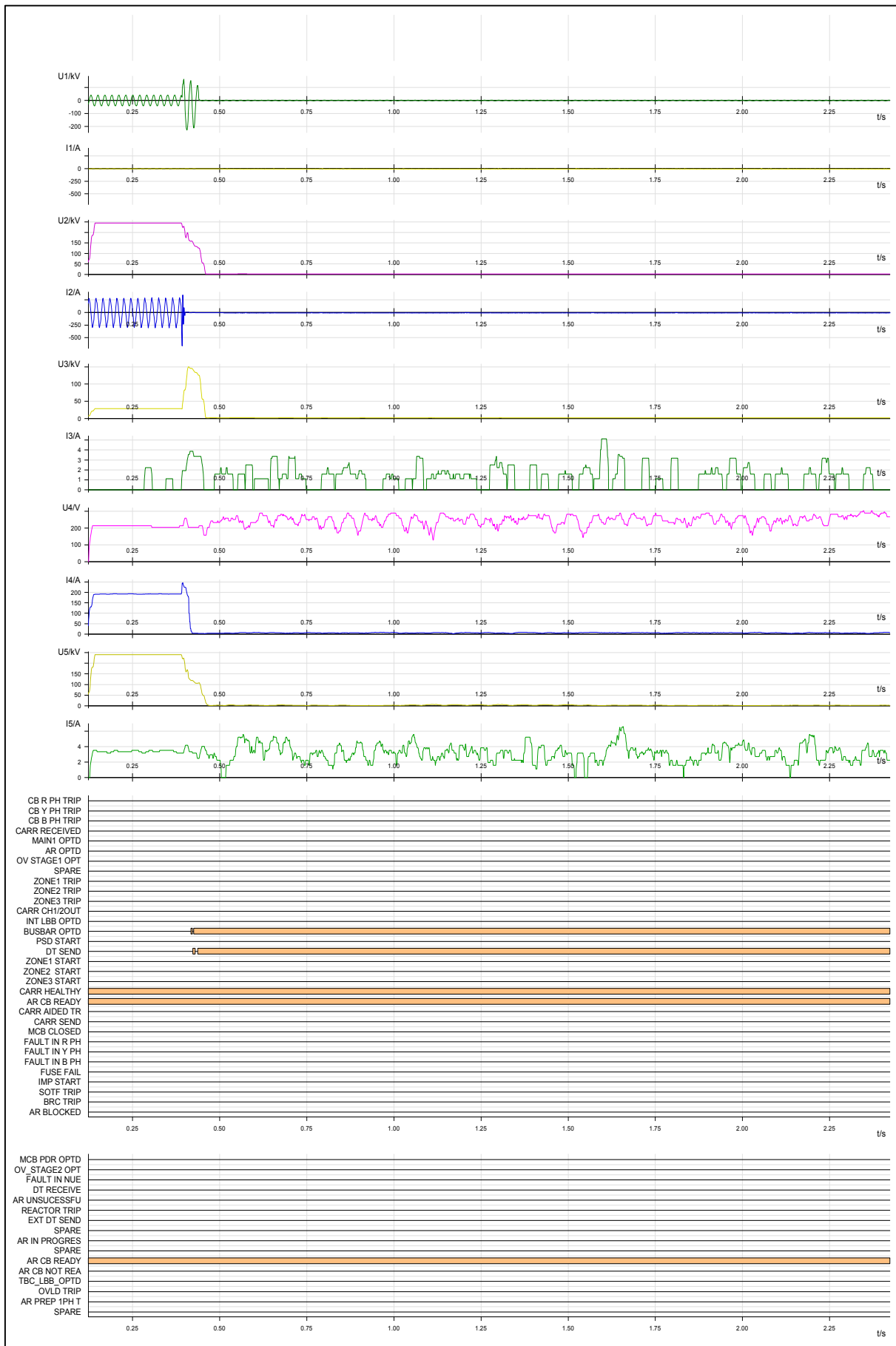


Fig: Bus bar protection DR

Grid Incidence at 400/220 kV Dhule Sub-station on 28th February 2016

Event Category: GI-2

Event Date and Time: 28th February 2016, 08:17 Hrs.

Event Summary: At 8:17 Hrs, Bus bar Zone-A protection for 400 kV got operated at 400/220 kV Dhule sub-station. At the time of Bus bar protection operation there was no actual bus fault or any other external fault. Also, no switchyard operation was going on at sub-station. The bus bar protection scheme is RADSS. The Flag indication which was observed for the scheme was only "U" i.e. tripping flag. There was no any phase indication i.e. either "R", "S", or "T". This implies that the the Bus bar mal-operation has occurred. The Bus bar operation led to tripping of all 400 kV Bus 1 connected elements and Bus coupler at Dhule S/s. At the time of restoration again bus bar protection zone-A again operated at 9:39 Hrs. During this second incidence, small spark was observed in B-phase RQDA module of RADSS scheme. Also on checking RQDA module slight carbonization observed at SR/DR card of B-phase RQDA module. This was cleaned up and again bus bar protection was taken into service and normalcy was restored. During this operation, ICT-3 tripped on bus bar protection and the load got shifted on 315 MVA ICT-1 & 2 and due to this Load Trimming Scheme operated leading to tripping of 220 kV Dhule-Chalisgaon.

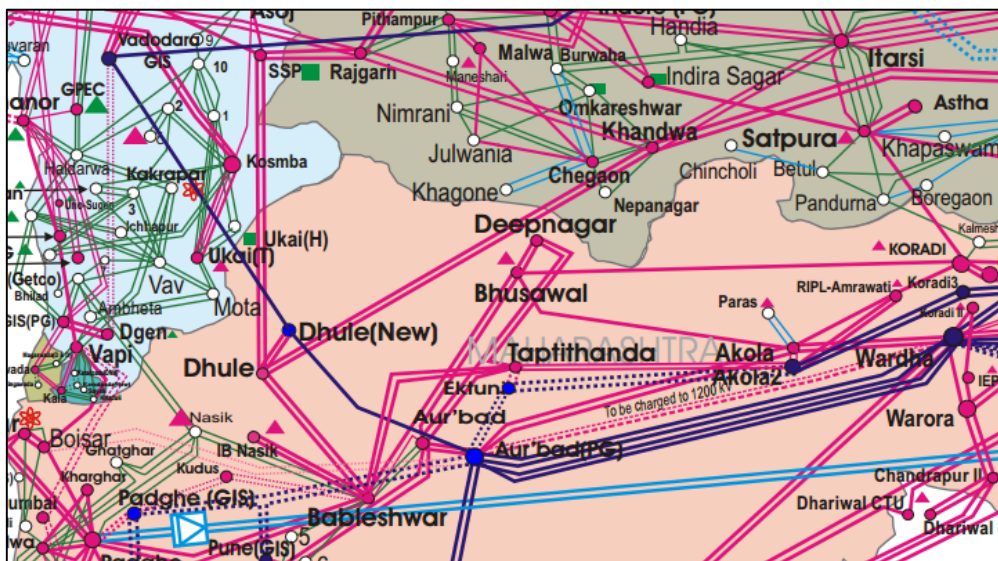


Figure 1 : Geographical Map

Event Overview: Details of event as received from MSETCL is attached as Annexure.

Load/Generation Loss: Nil



MAHA TRANS CO

Maharashtra State Electricity Transmission Co. Ltd.

MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO.LTD.

| | |
|---|---|
| From: Name of Office: Superintending Engineer Office address: Testing & communication circle Block No.12 MSETCL Admin Bldg. Racca Plot, Old Saykheda Road, Jail Road, Nashik (422101) Contact No: 2403181 Email Id: se5500@mahatransco.in | To, The Chief Engineer, Trans O&M, MSETCL, C.O. Mumbai. |
|---|---|

Ref. No. SE/TCC/NSK/T/No. 109

Date: 09/03/16

Sub.:- Occurrence report of operation of 400kV BB protection at 400 KV R/S Dhule 28.02.2016 @ 08:17Hrs

On dt.28.02.2016 @ 08:17 Hrs the 400 kV Bus Bar Zone-A (Bus-1) optd at 400 kV Dhule Ss. The detailed relay indications for 400kV Bus Bar Panel is as-

| Date and Time | BB panel Indication |
|--------------------|--|
| 28.02.2016 @ 08:17 | Main Bus –I (Zone-A) Optd, 'U' Flag Optd. (U Tripping Flag), 96 Trip relay of 400kV BBLR-1, Khandwa-2, Songir-1, 501 MVA ICT-3 |

| Sr No | Feeder/ICT | Local end | | Remote end | |
|-------|----------------------|----------------------|---|--|--|
| | | WI | RI | WI | RI |
| 1 | 400kV Dhule-Khandwa | Nil | 96 Trip Relay Optd | DT received | 1) DT Received 2) Group A/B relay Optd. |
| | 400kV Dhule-BBLR | 1) A/R lock out | 96 Trip Relay Optd | 1) DT-1/2 Received. 2) Auto Reclose Lockout | 1) 3 ph trip relay optd. |
| | 400kV Dhule-Songir-1 | A/R Optd. A/R L/O | 1) 96 Trip Relay Optd 2) 86 Trip relay | DT Received | Nil |
| | 501 MVA ICT-3 | SCADA | Master Trip Relay optd-186 & 286 (on SCADA), 96 | NA | NA |

| | | | | | |
|--|-----------|---------|------------------|----|----|
| | | | Trip relay Optd. | | |
| | 400kV B/C | BB Optd | | NA | NA |

Analysis:-

On dt 28/02/16 @ 8:17 Hrs at 400kV Dhule SS, Busbar Zone-A get operated. At the time of Busbar there was no actual bus fault or any other external fault too. Also no switchyard operation was going on at station. The bus bar scheme is RADSS. The Flag indication which was observed for the scheme was only "U" i.e. tripping flag only. There was no any phase indication i.e. either "R", "S", or "T". this implies the Busbar mal-operation. At the time of restoration again bus bar protection zone-A operated @ 9:39Hrs. During this second incidence, small spark was observed in B-phase RQDA module of RADSS scheme. Also on checking RQDA module slight carbonization observed at SR/DR card of B-ph RQDA module (image file enclosed). This is cleaned up and again bus bar protection taken into service and normalcy restored. During this operation, ICT-3 tripped on bus bar protection, load get shifted on 315MVA ICT-1&2 and due to this Load Trimming Scheme operated and 220 kV Chalisgaon line tripped @ 08:18 on dt.28.02.2016.

With LD Nagpur permission Restoration carried out

L.B.T& Restoration:

| Sr. No. | Feeder | Restoration Time | LBT in MW |
|---------|--------------------|------------------|-----------|
| 1 | 400 kV bus coupler | 12:06 hrs. | |
| 2 | 400 kV BBLR-1 | 12:13 hrs. | 219I |
| 3 | 400 kV Songir-1 | 12:21 hrs. | 222I |
| 4 | 501 MVA ICT-3 | 12:25 hrs. | 279E |
| 5 | 400 kV Khandwa-2 | 12:31 hrs | 323I |

Remedial Measures:

The RADSS scheme is old scheme and rendered service more than 15yr and hence replacement is already proposed.

Submitted for your kind information please.

Encls: SLD

Superintending Engineer
TCC, MSETCL, Nashik

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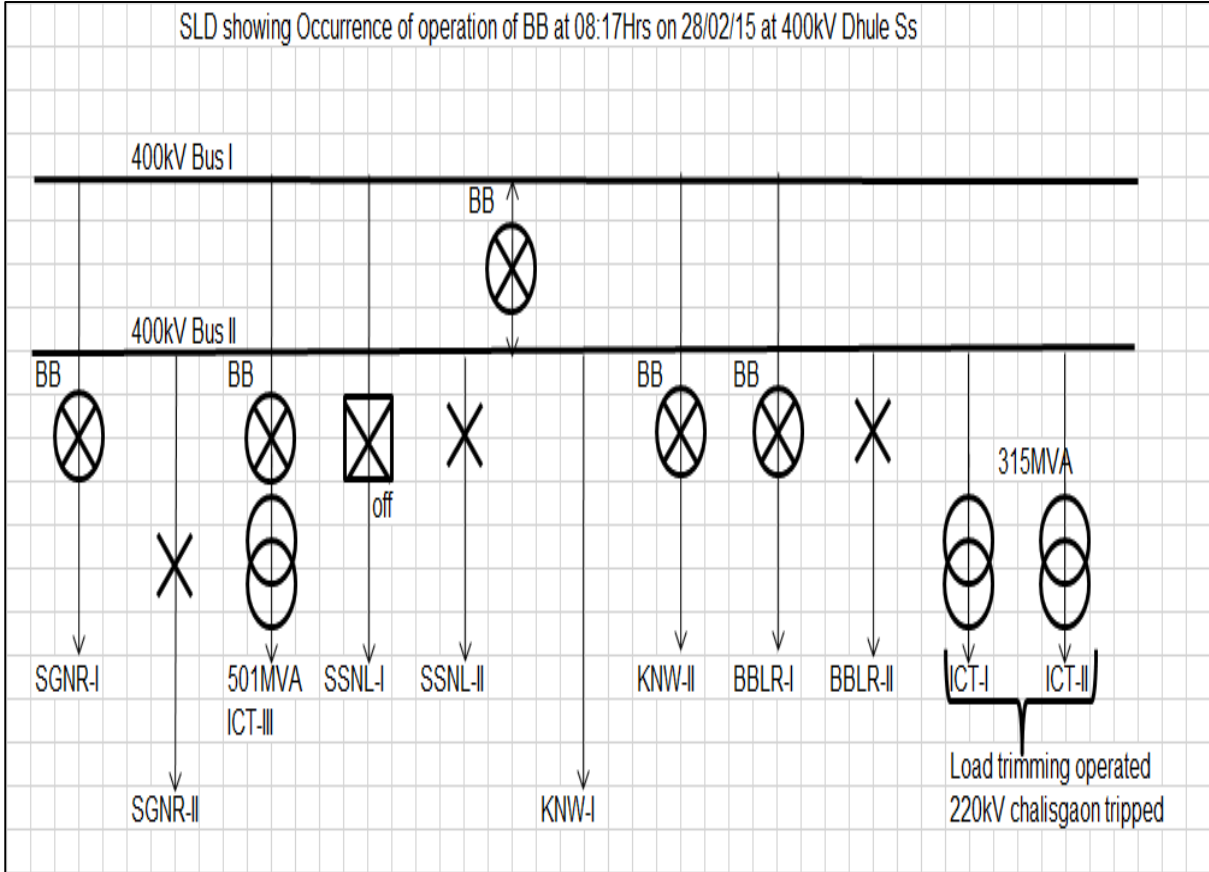
- 1) The Chief Engineer, EHV CC O&M Zone, MSETCL,Nashik.
- 2) The Chief Engineer, SLDC, MSETCL,Kalwa.

Copy f.w.cs.to :

- 1) The S.E., EHV O &M, Circle, MSETCL,Bhusawal.

Copy to:

- 1) The E.E., Testing Dn., MSETCL, Dhule.
- 2) The E.E., 400kV R.S. O&M Dn., MSETCL, Dhule.



Grid Incidence at Karad and nearby area due to Fog on 12th February 2016

Event Category: GI-2

Event Date and Time: 12th February 2016, early morning Hour.

Event Summary: Due to fog near Karad area in Maharashtra, Many of the 400 and 220 kV lines tripped on fault. However there was no interruption in any other area in the system.

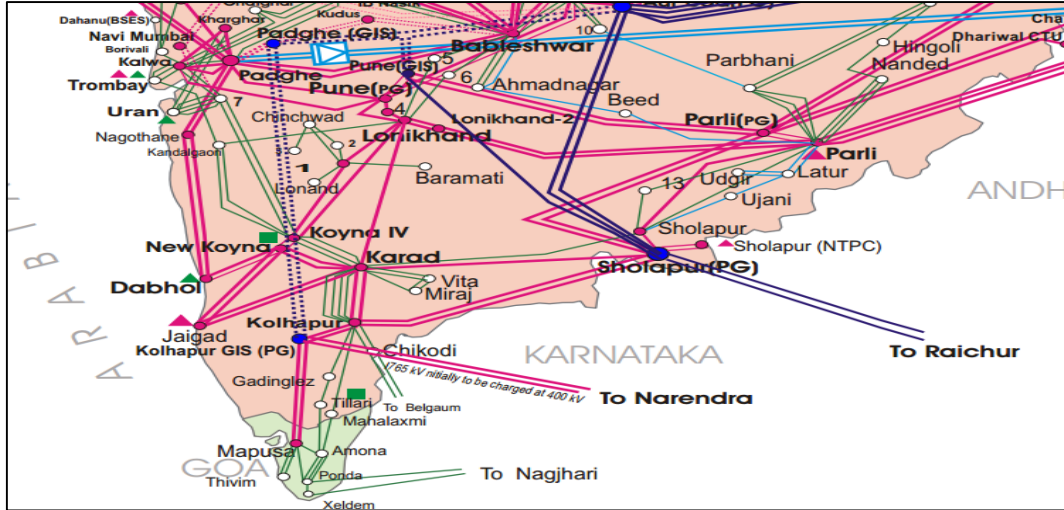


Figure 1 : Geographical Map

Antecedent Condition:

Prior to the event, 400 kV Karad-Kolhapur 1, 400 kV Lonikhand-Koyna 4 and 400 kV Karad-Jaigad 2 were in open condition to control the high voltage situation in the area.

Event Overview and Analysis:

Due to foggy weather in Karad area, several lines started tripping on fault. The fault has been analysed using PMU data from 400 kV Solapur (PG) as DR file were not received from the utilities so far.

- 1. Tripping of 400 kV Jejuri-Koyna IV on R phase to E/F at 05:54 Hrs :** The circuit tripped on R phase to E/F however no A/R operation was observed in the circuit from either end.

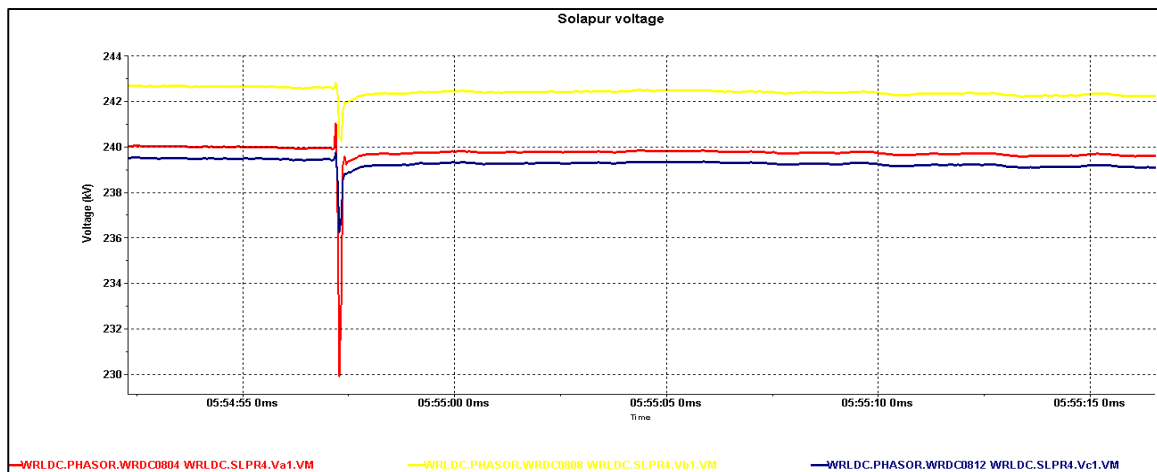


Figure 2 : 400 kV Solapur Bus voltage indicating R phase to E/F on 400 kV Jejuri-Koyna IV. No A/R is observed on the circuit.

2. **Tripping of 400 kV Karad-New Koyna 2 on B phase to E/F at 06:08 Hrs:** The circuit tripped on B phase to E/F and A/R operation is also observed. Fault has persisted on the circuit.

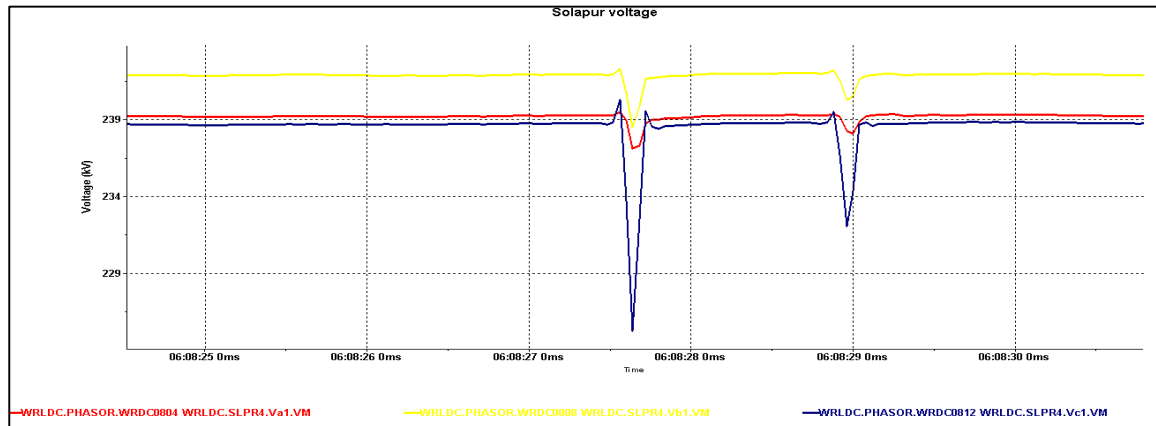


Figure 3 : 400 kV Solapur Bus voltage indicating B phase to E/F on 400 kV Karad-New Koyna 2 . A/R is observed on the circuit.

3. **Tripping of 220 kV Karad -Mudshingi 2 on R phase to E/F at 06:36 Hrs:** The circuit has tripped on R phase to E/F however no A/R operation was observed on the circuit.

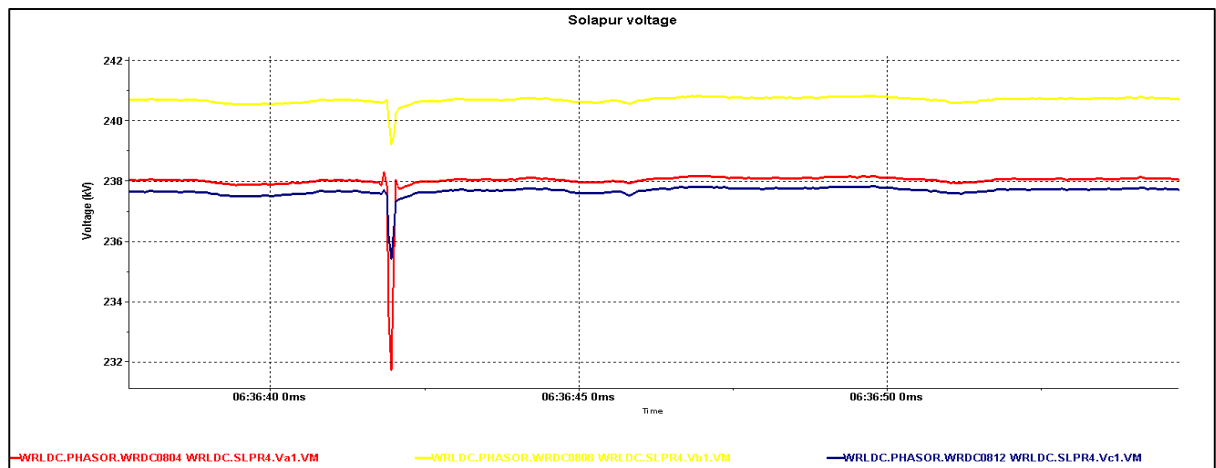


Figure 4 : 400 kV Solapur Bus voltage indicating R phase to E/F on 220 kV Karad-Mudshingi 2. No A/R is observed on the circuit.

4. **Tripping of Karad-New Koyna 1 circuit on R phase to E/f at 06:48 Hrs:** The circuit tripped on R phase to E/F. No A/R operation was observed on the circuit.

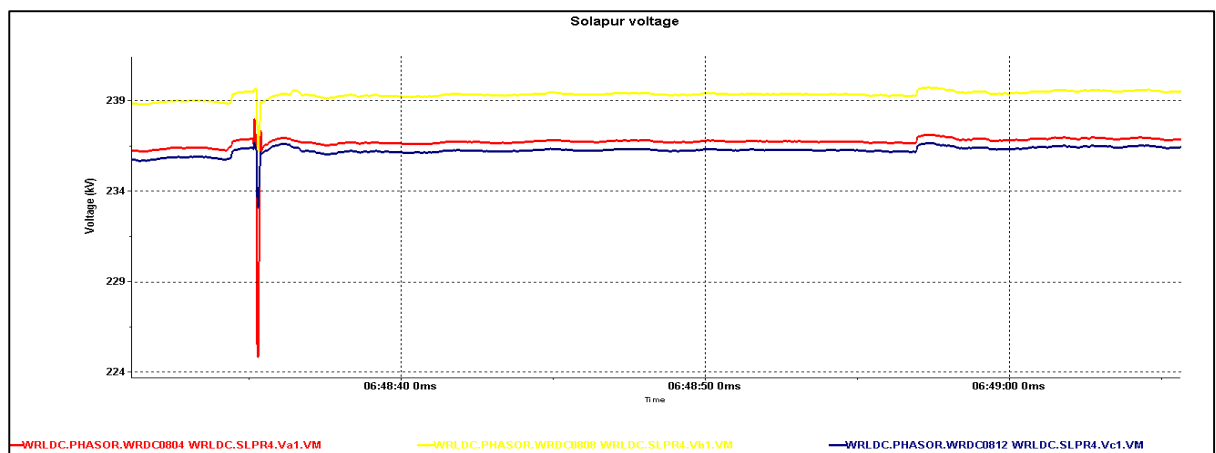


Figure 5 : 400 kV Solapur Bus voltage indicating R phase to E/F on 400 kV Karad-New Koyna 1. No A/R is observed on the circuit.

5. **400 kV Karad-Kolhapur 2 on R phase to E/f at 07:07 Hrs:** The circuit tripped on R phase to E/F and A/R operated, however due to persisting fault line tripped.

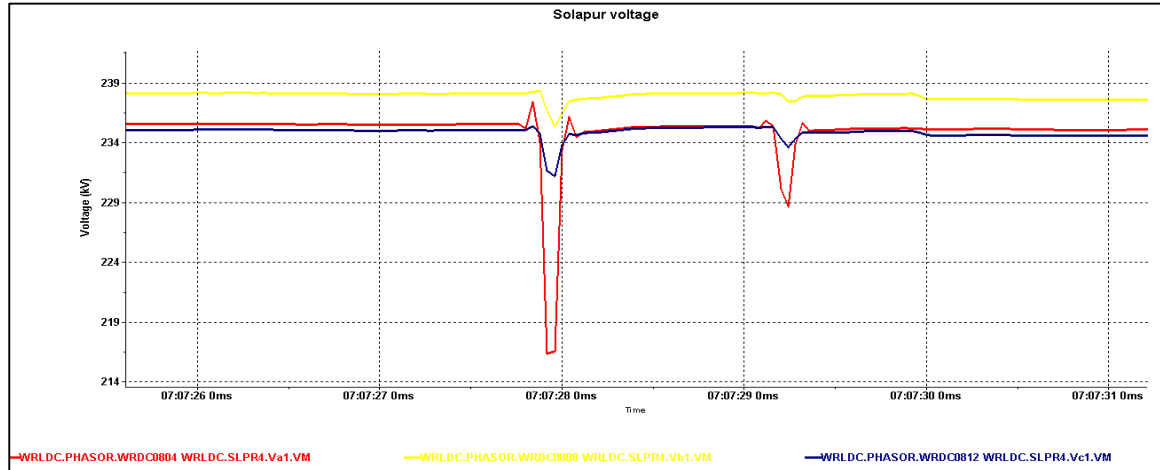


Figure 6 : 400 kV Solapur Bus voltage indicating R phase to E/F on 400 kV Karad-Kolhapur 2. A/R is observed on the circuit.

6. **400 kV Kolhapur-Kolhapur PS (GIS) 1 on B phase to E/F at 07:09 Hrs. :** B phase to E/F occurred on circuit and line got reclosed from Kolhapur end but remained opened from Kolhapur PG (GIS) end .

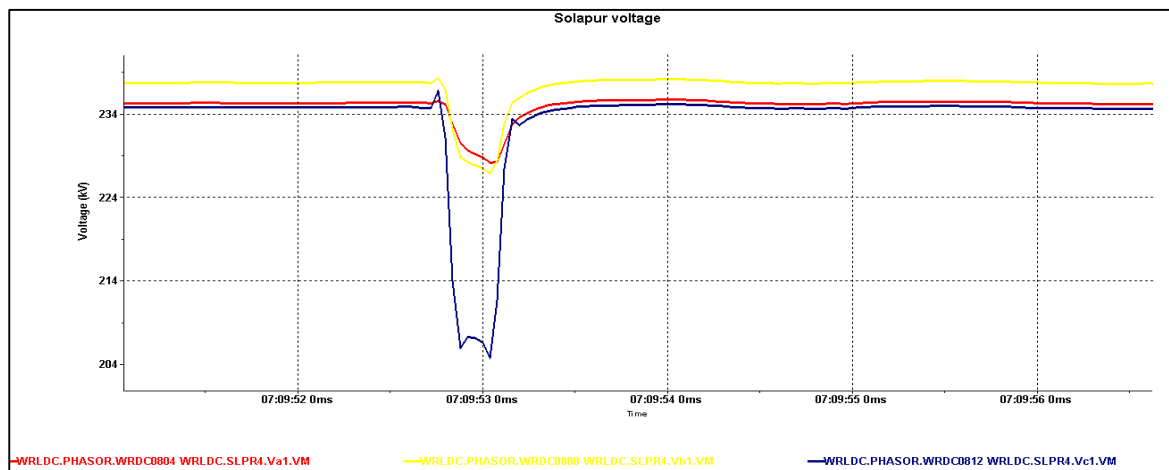


Figure 7 : 400 kV Solapur Bus voltage indicating B phase to E/F on 400 kV Kolhapur-Kolhapur PG 1.

7. **220 kV Karad-Nigde tripping on R phase to E/F at 07:45 Hrs:** Circuit tripped on R phase to E/F . No A/R operation was observed on the circuit.

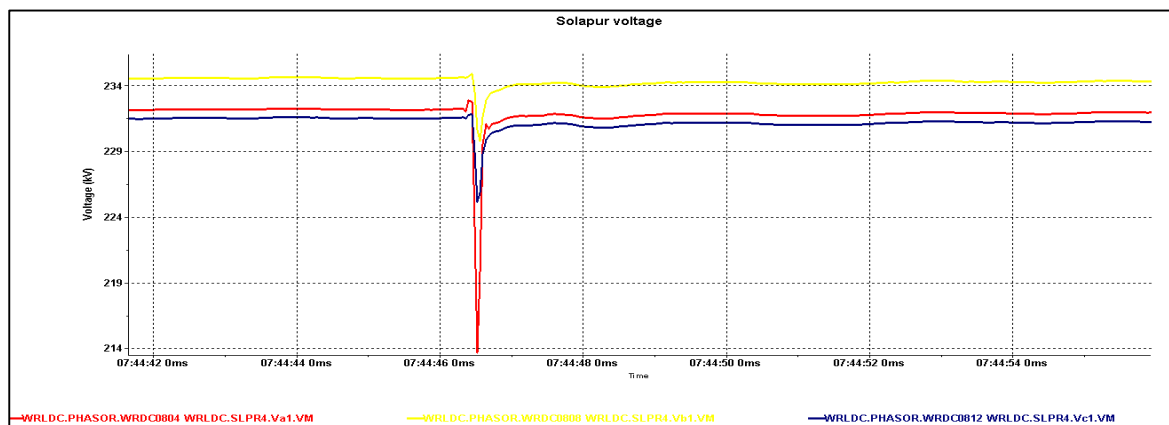


Figure 8 : 400 kV Solapur Bus voltage indicating R phase to E/F on 220 kV Karad-Nigde circuit.

Table 1 : Sequence of events

| Elements | Tripping Time | Relay Indication at End 1 | Relay indication at End 2 | Restoration Time |
|--------------------------------|---------------|------------------------------------|---------------------------|------------------|
| 400 kV Jejuri –Koyna Stage 4 | 05:54 | R phase to E/F | R phase to E/F | 15:52 |
| 400 kV Karad-New Koyna 2 | 06:08 | B phase to E/F | B phase to E/F | 18:35 |
| 220 kV Karad - Mudshingi 2 | 06:36 | R phase to E/F | R phase to E/F | 10:13 |
| 400 kV Karad-New Koyna 1 | 06:48 | R phase to E/F | R phase to E/F | 18:22 |
| 220 kV Kolhapur - 5 Star 1 | 07:03 | DPR operated | DPR operated | 15:18 |
| 400 kV Karad-Kolhapur 2 | 07:07 | R phase to E/F | R phase to E/F | 17:39 |
| 400 kV Kolhapur-Kolhapur(PG) 1 | 07:09 | B Phase to E/F. Got auto-reclosed. | B Phase to E/F | 07:51 |
| 220 kV Karad-Nigade | 07:45 | R phase to E/F | R phase to E/F | 08:16 |

* Based on WRLDC SCADA SOE/PMU

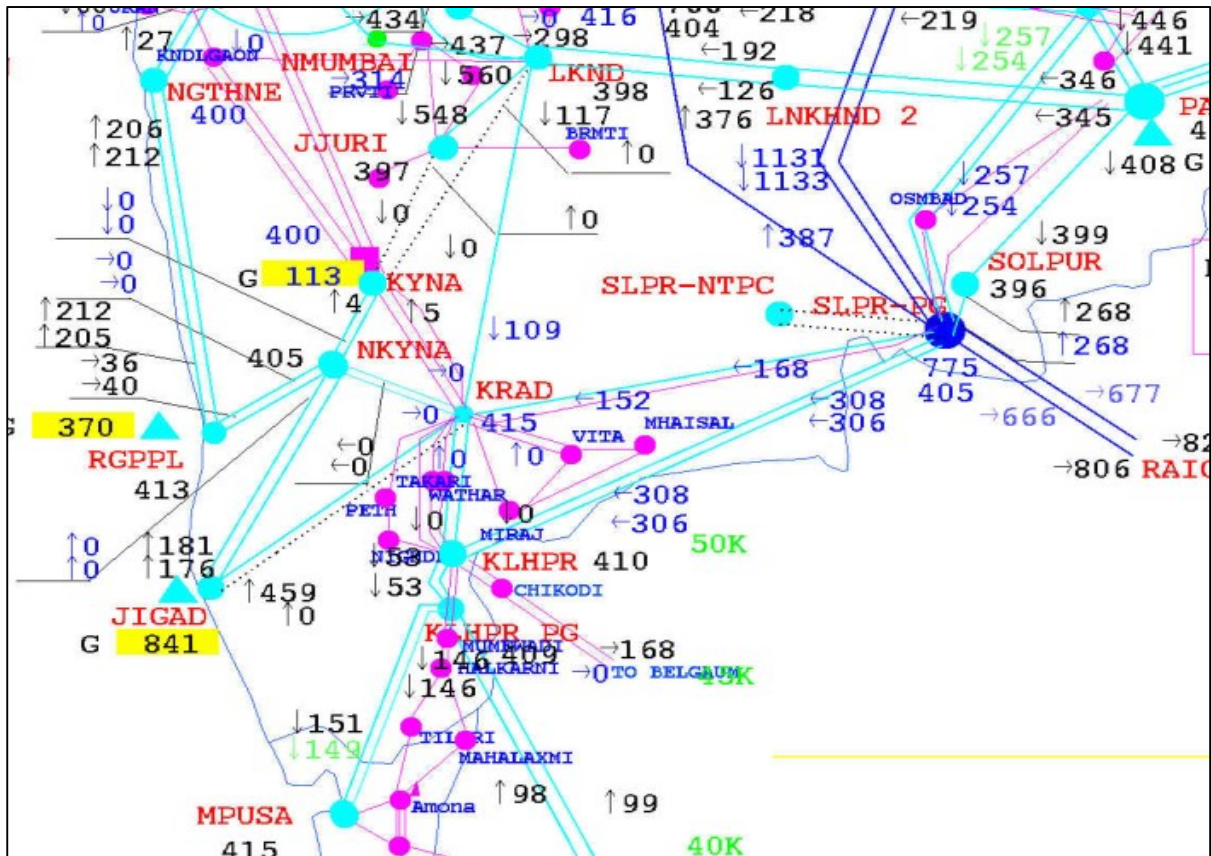


Figure 9 : SCADA snapshot of the Karad area after the fog tripping. It can be observed that data from many places are not coming to WRLDC which makes monitoring and control difficult to WRLDC (Data in blue are not updating)

Restoration: Trail attempt were taken on 400 kV Lonikhand-Koyna 4 circuit which was in open condition on high voltage at 06:40HRS and 07:29hrs but the line tripped on Y phase to E/F fault on both occasions. So, charging of other circuits were not attempted during for fog period. Lines were restored one by one after reduction in the fog.

Protection and Operation Related Issues:

- In many cases non operation of A/R was observed which is highly undesirable.
- **MSETCL and PGCIL WR-1** may kindly look into the event where no A/R operation has occurred and send the reason for the same to WRLDC/WRPC.
- No DR/EL has been received from **MSETCL and PGCIL WR-1** which is a non-compliance of IEGC 5.2.r and CEA grid standard 15.3. Both utilities are advised to send DR and EL in the prescribed format to WRLDC/WRPC within 24 hours of the event.

Annexure: MSETCL Report



MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO. LTD.

| | |
|--|---|
| From, Office of the Superintending Engineer, Testing & Communication Circle, 4 th Floor, MSEB Adm. Bldg., Sector-17, Vashi, Navi Mumbai-400703. Tel: (022) 27656040 / 27656039 Fax: 27653463 E-Mail: se7500@mahatransco.in setccvashi@rediffmail.com | To, The Chief Engineer, EHV CC O&M Zone, M. S. E. T. Co. Ltd., Vashi. |
|--|---|

Ref: SE/TCC/VSH/Tech/No. 475

Date: 11.12.2015

Sub: Occurrence at 400/220kV Padghe S/S on dated 10.12.2015 at 19:52 hrs.**Ref:** L. No. EE (T), Padghe L.No.EE/HVDC/T&T/DN/PDG/Tech/No. 07 dtd.11.12.2015

On 10.12.2015 at 19:52 Hrs, the 400kV Bus Bar Zone -1 is operated while opening the main bus -1 isolator of 400kV Babhaleshar-1 subsequent to arcing & fire seen on Y pole CB at 400kV Padghe s/s & all the 400kV lines & ICTs connected to 400kV Main bus-I tripped at Padghe s/s.

Due to tripping of 2 x 315MVA, 400/220kV ICT-1 & 2, connected to Bus -1, the load trimming stage-1 scheme for 400 kV ICTs is also found to be operated at Padghe s/s. The total load relief obtained is about 360MW for @ 45 minutes.

The your good self along with SE (Padghe) & SE (TCC Vashi) visited the Padghe s/s on 11.12.2015 to find the cause of occurrence.

The occurrence in detail is as below:**A. 400kV Bus configuration & load prior to occurrence at Padghe S/S is as under:**

| Sr. No. | Feeder Name / ICT on 400kV Main Bus-I – A | Load in MW @ 19.52 hrs | Feeder Name / ICT on 400kV Main Bus-II- B | Load in MW @ 19.52 hrs |
|---------|---|------------------------|---|------------------------|
| 1 | 400kV HVDC-2 | 690 (I) | 400kV HVDC-1 | 555 (I) |
| 2 | 400kV Babhaleshwar-1 | Out | 400kV Babhaleshwar-2 | 540 (I) |
| 3 | 400kV Tarapur-1 | 111 (I) | 400kV Tarapur-2 | 109 (I) |
| 4 | 400kV Nagothane -2 | 13 (I) | 400kV Talegaon | 202 (I) |
| 5 | 400kV Kalwa-1 | 418 (E) | 400kV Nagothane -1 | 13 (I) |
| 6 | 400kV Kharghar | 322 (E) | 400kV Kalwa-2 | 418 (E) |
| 7 | 3 x105MVA, 400/220/33kV ICT-1 | 208 (E) | 315MVA, 400/220/33kV ICT-3 | 321 (E) |
| 8 | 315MVA, 400/220/33kV ICT-2 | 224 (E) | 400kV Boisar | 15 (I) |
| 9 | 80MVAR Reactor | NA | 3X 200MVA, 400/220/33kV ICT-4 | 448 (E) |

B. The Indications appeared were as under:

| Sr. No | Name of Bay | Local End Indication | | Remote End Indication | |
|--------|---------------------------------|-------------------------|--|---|--------------------------|
| | | WI | RI | WI | RI |
| 1 | 400kV bus –coupler | Bus Bar Zone 1 operated | 96 T operated | NA | NA |
| 2 | 3x 105MVA 400/220/33KV ICT-1 | NIL | 96 T operated , Group 1 & 2 trip relay optd. | NA | NA |
| 3 | 315MVA 400/220/33KV ICT-2 | NIL | 96 T operated , 3- Phase trip relay 86 optd. | NA | NA |
| 4 | 400KV Kalwa-1 | NIL | 96 T operated , Group- A & B trip relay optd. Direct trip send, | DT CH-1 & 2 Received | LED: R- PH, Y- PH; |
| 5 | 400 KV Kharghar | NIL | 96 T operated , Direct trip send; Fault value: Ir-1633 A; Iy- 2144 A, Ib-486.7 A, In-54.91. | DT CH-1 & 2 Received | LED: R- PH, Y- PH; |
| 6 | 400 KV Babhleshwar-2 | NIL | NIL | NIL | NIL |
| 7 | 400 KV HVDC-2 | NIL | 96 T operated , | NA | NA |
| 8 | 400 KV Nagothane -2 | NIL | 96 T operated , Group-A & B relay optd. Direct trip send; Fault value: Ir-2191 A; Iy- 2093 A; ib-285 A | Definite trip, A/R L/O, DT received. | NIL |
| 9 | 400KV Tarapur-1 | NIL | 96T Operated; Direct trip send, Zone-4 start; Fault value: Ir- 2290A, Iy-2078A. Ic -214 | AR L/o relay optd; carrier L/O optd | NIL |

400kV BUS BAR Relay (Make: Siemens, Type: SIPROTEC 7SS52):

LED:

- 1) R PH TRIP
- 2) Y PH TRIP
- 3) BB1 TRIP

TRIP LOG:

- 1) Trip MB1 L1 ON;
- 2) Trip MB1 L2 ON;
- 3) BB1 Trip

C. Observations & Analysis: (Pl. ref. SLD & DR)

- On 10.12.2015, the 400kV Padghe-Babhleshwar -1 line was under outage for line maintenance work.

- During the outage period, the DCRM measurement of said line CB was also carried out & result found in order.
- After completion of line maintenance work, the process for taking line into service was started with confirmation that CBs are open at both ends.
- Further, after cancellation of cross permit, earth isolator was opened at both end & line isolator was closed. Subsequently 400kV main bus-1 isolator was also closed at Padghe s/s.
- As soon as the bus isolator was closed, the abnormal sound in Y-pole of CB was heard by operator on duty & line side CB main contact porcelain insulator burst followed by heavy sparking & fire.
- The shift in-charge has observed the current of @ 135A in Y phase only on Panel meter.
- Immediately after the above incidence (about 10 min.), the 400kV main bus-1 isolator of 400kV Padghe-Babhaleshwar-1 line opened to avoid further damages/incidence.
- At 19:52 Hrs, during the isolator opening process, heavy sparking observed on Y-pole isolator. Due to ionization of surrounding air, it created R-Y phase bus fault in the system, resulting into operation of 400kV bus-bar Zone-1 protection.
- This has resulted into operation of 400kV Bus-bar Zone-1 & all the 400kV lines & ICT/TF connected to 400kV Main bus-I tripped within @ 53 msec at Padghe s/s.
- All the 400kV lines connected to 400kV Main bus-I at Padghe tripped at remote end also on DT receipt on operation of bus-bar protection.
- Due to tripping of 3 x105MVA, 400/220/33kV ICT-1 and 315MVA, 400/220/33kV ICT-2; the remaining two nos. of ICTs i.e. 3 x 200MVA, 400/220/20kV ICT-4 and 315MVA, 400/220/33kV ICT-3 got overloaded causing operation of Load Trimming Scheme stage-1 at Padghe s/s. The total load on 4 nos. of ICTs before the incidence was about 1201MW.
- Due to the operation of load trimming scheme at Padghe, the other two 400kV ICTs remains in service.
- The quantum of Load relief obtained due to operation of load trimming is as follows.

| Sr. No. | Name of Feeder | From | To | Duration | Load Relief (MW) |
|-----------------------------------|-----------------------------|-------|-------|-----------|------------------|
| 1 | 100 KV Padghe- Murbad 1 | 19:52 | 20:34 | 00.42 Min | 18.00 |
| 2 | 100 KV Padghe –Murbad 2 | 19:52 | 20:34 | 00.42 Min | 19.00 |
| 3 | 100 KV Padghe –Mohane | 19:52 | 20:33 | 00.41 Min | 66.00 |
| 4 | 100 KV Padghe –Ambarnath | 19:52 | 20:32 | 00.40 Min | 53.00 |
| 5 | 22kV feeder at Padghe s/s | 19:52 | 20:39 | 00.47 Min | 46.00 |
| 6 | 22kV feeder at Bhiwandi s/s | 19:52 | 20:39 | 00.47 Min | 122.00 |
| 7 | 22kV feeder at Shahapur s/s | 19:52 | 20:39 | 00.47 Min | 36.00 |
| Total Load relief obtained | | | | | 360.00 |

- After analyzing DR extracted from the bus bar protection & distance protection of 400kV Babhaleshwar-1 at Padghe, it is seen that 400kV Y-pole of CB found partially opened as DR indicate presence of Y-phase Line PT supply & Line charging current @ 150 A only (other R&B phase current & line voltage is absent) which match with operator's observation.
- Due to this partially opening of CB Y pole, line capacitive charging current is flown through as soon as the main bus isolator is closed which further burst due heavy arcing & fire inside the pole being partially opened.
- Further, with the partially opening of CB pole condition, the bus isolator opened which is phenomena of on load opening of isolator which discharges the heavy capacitive line charging current of open ended line from remote end & heavy arcing took place. Due to ionization of surrounding air, it creates R-Y phase bus fault in the system, resulting into operation of 400kV bus-bar Zone-1 protection.
- The 400kV Padghe-Babhaleshwar -1 CB is of CGL makes (Sr. No. - 23393, Type-400SFM40A, YOM-2006) & commissioned on 09.07.2007 under LES Scheme at Padghe s/s. The CB mechanism overhauling is carried out on 17.07.2015.
- Subsequent to failure of CB, the Y-pole is dismantled on 11.12.2015. It is observed that the Y-pole male & female contacts are completely burnt & damaged due to continuous arcing.
- Operating rod linkage of CB is found broken. This leads to partial opening /closing of CB pole power contact lastly tripped after DCRM measurement.
- The failure of CB is due to mechanical failure.
- This case of failure of CB pole is referred to M/s CGL for detailed analysis.

D. Restoration:

400kV Main Bus I charged through bus coupler at 20:05HRS. & Normalcy restored one by one as below:

| Sr. No. | Name of Bays | Tripping | | Restoration | |
|---------|------------------------------------|------------|------------|-------------|------------|
| | | Date | Time (Hrs) | Date | Time (Hrs) |
| 1 | 400 kV bus –coupler | 10.12.2015 | 19:52 | 10.12.2015 | 20:05 |
| 2 | 400 kV HVDC 2 | | 19:52 | | 20:10 |
| 3 | 315 MVA 400/220/33KV ICT-1 | | 19:52 | | 20:14 |
| 4 | 400 kV Nagothane 2 | | 19:52 | | 20:21 |
| 5 | 400 kV Kalwa-1 | | 19:52 | | 20:23 |
| 6 | 400 kV KHARGHAR | | 19:52 | | 20:35 |
| 7 | 400 kV Tarapur-1 | | 19:52 | | 20:58 |
| 8 | 400 kV Babhleshwar-1(Through TBC) | | 19:52 | | 23:18 |

| | | | | | |
|---|----------------------------|--|-------|--|-------|
| 9 | 315 MVA 400/220/33KV ICT-2 | | 19:52 | | 23:49 |
|---|----------------------------|--|-------|--|-------|

E. Remedial Measures to be taken:

- In this case , it was advisable to trip the all the breakers connected to Bus-1 to make the bus dead under intimation to LD Kalwa as the opening of isolator on capacitive charging current can be risky from operational safety & system security point of view.

However, it may also be noted that , as seen from Padghe system network, the Padghe operator cannot take such decision independently without consultation to LD which may delay the operational action further & then anything happened in between cannot be predicted. This should be noted from operational safety & system security point of view in future.

- The necessary instruction should be passed on to operating staff /shift in-charge that after closing the both isolators i.e. bus & line of line, it should be confirmed that the ABT or panel meter did not indicate any load current.
- The Executive Engineer, 400kV RS O&M Dn., Padghe is requested to take the issue of failure of CB with M/s CGL for further detailed analysis & remedial action.
- The DCRM report is forwarded to M/s. SCOPE for expert comments.

Submitted please.

Encl: A/a



Superintending Engineer,
Te sting& Communication Circle, Vashi.

Copy s.w.r.to:

The Chief Engineer (Tr. O&M), C.O., MSETCL, Mumbai.
The Chief Engineer (SLDC), MSETCL, Kalwa.

Copy f.w.c.to:

The Superintending Engineer, HVDC RS O&M Circle, Padghe.
The Superintending Engineer, EHV O&M Circle, Kalwa.
The Superintending Engineer, EHV O&M Circle, Panvel.

Copy to:

The Executive Engineer, HVDC-T&T Dn., Padghe/ Testing Division, Kalwa/ Panvel

The Executive Engineer, 400KV RS O&M Dn., Padghe.
The Executive Engineer, EHV O&M Dn, Dombivali/Kalwa

CC to:

The WRLDC, Mumbai

**Regd. Office: "Prakashganga", Plot No.C-19, "E" Block, Bandra – Kurla Complex Bandra (E),
Mumbai. 400 051**

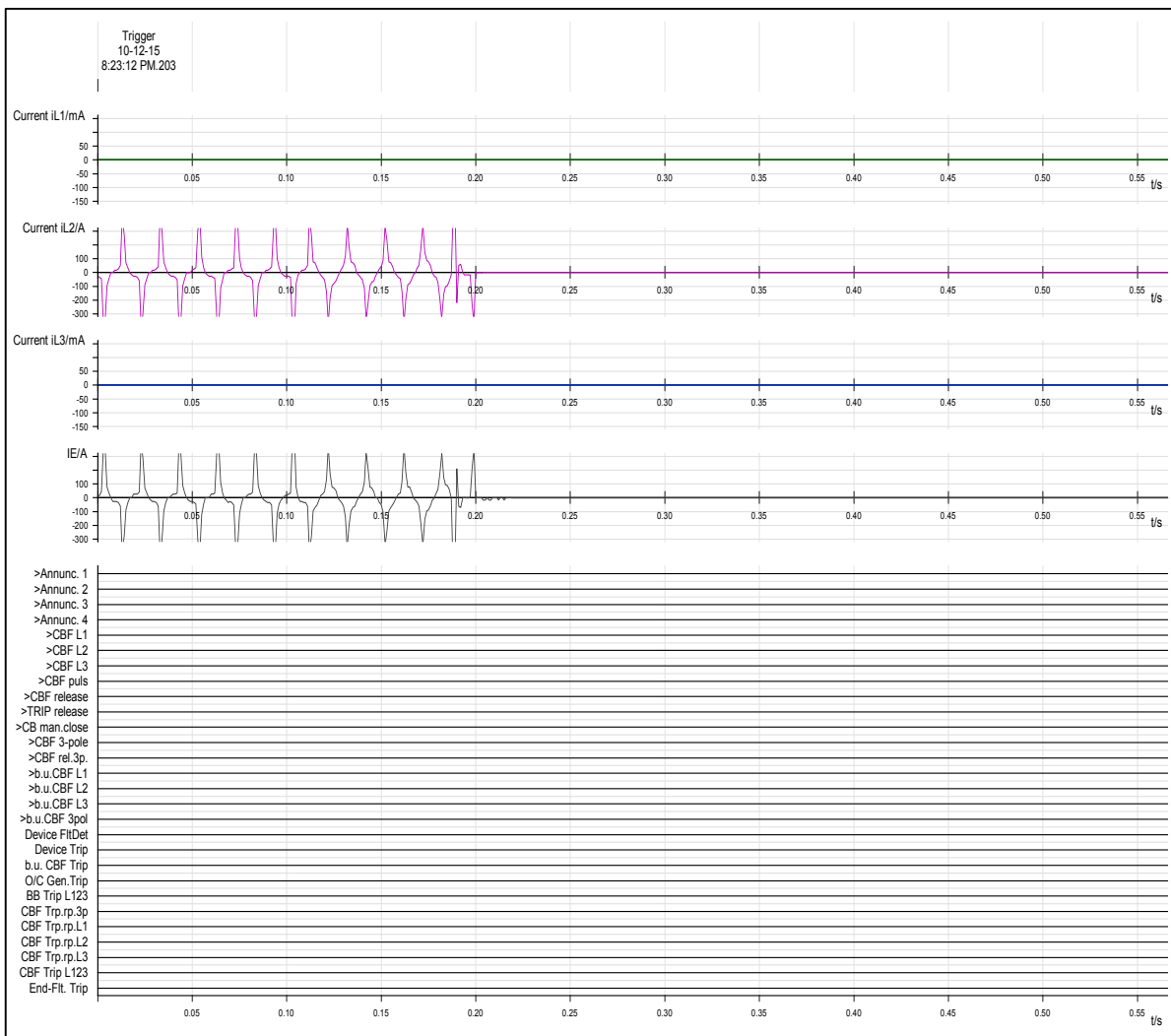
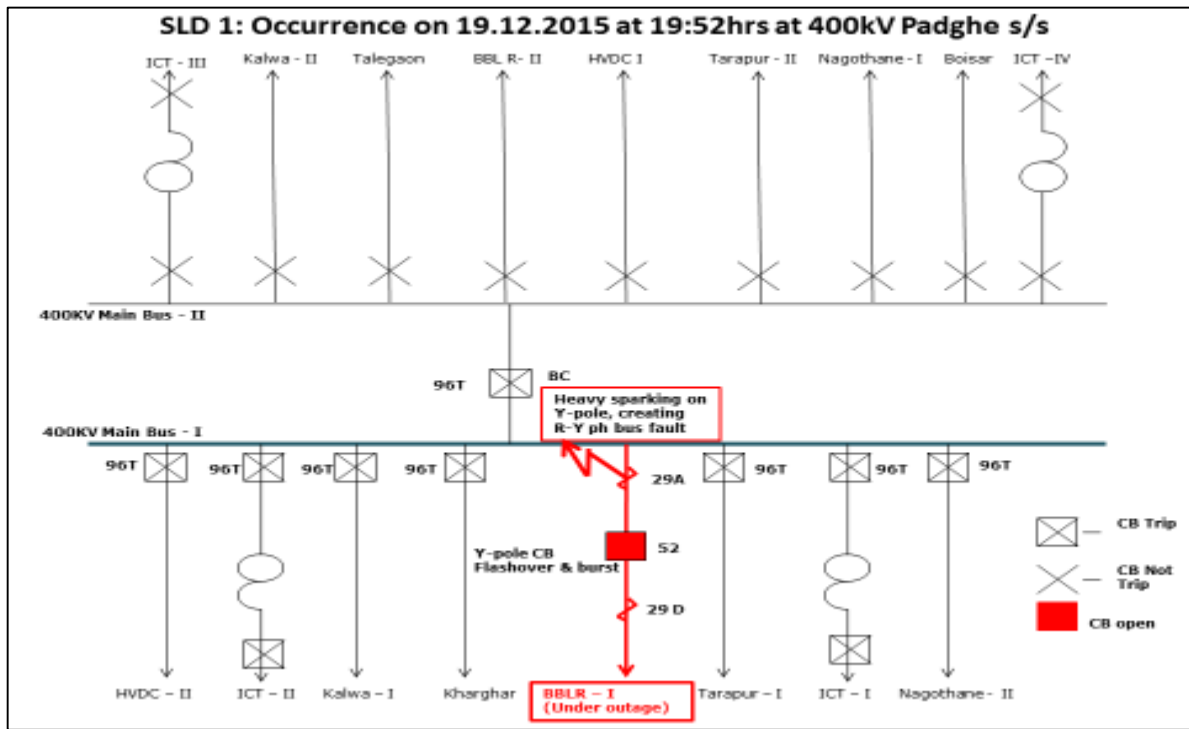


Fig : DR of Bableshtar-Padghe 1 at Bableshtar end

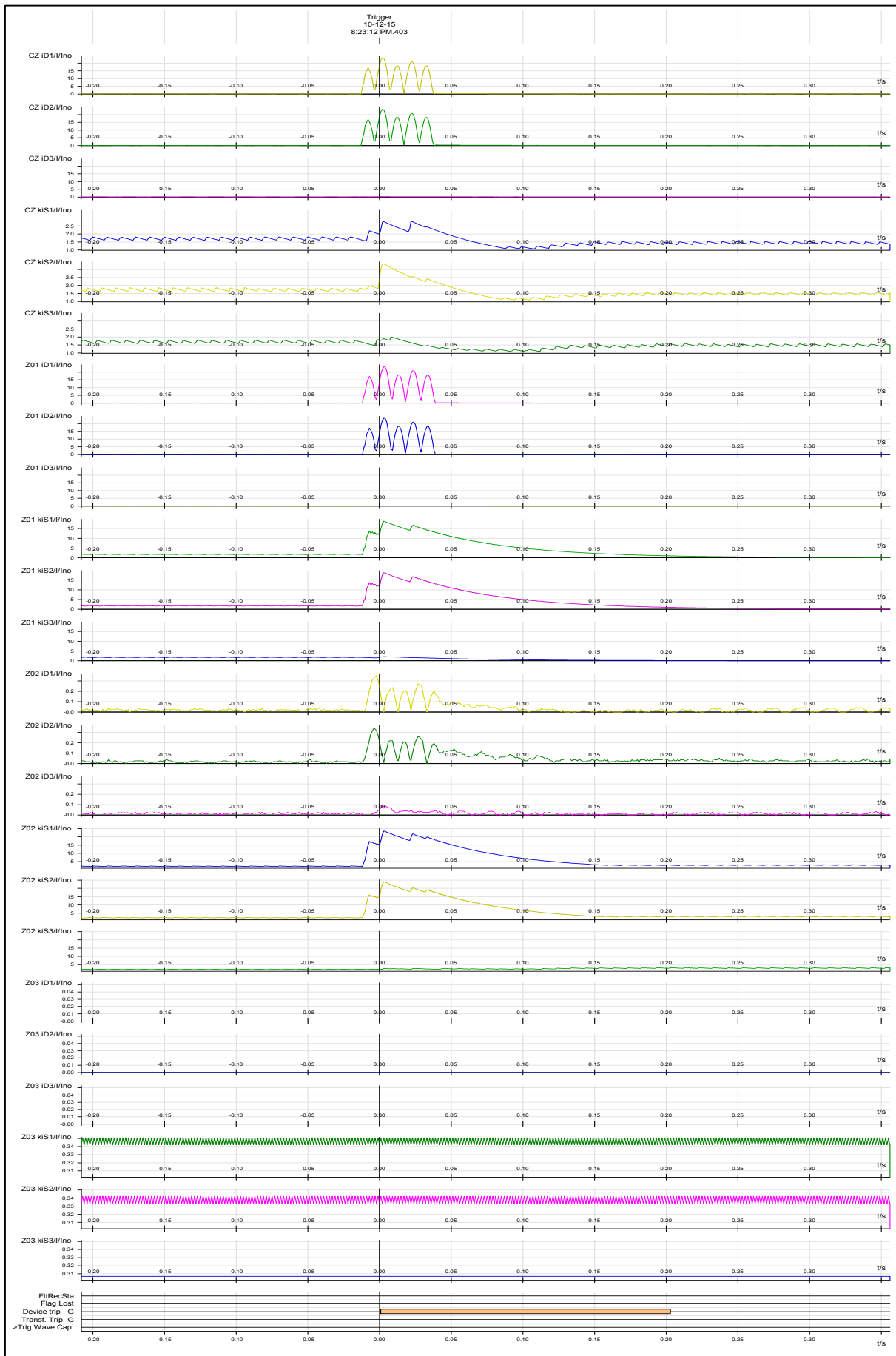


Fig: Bus bar protection DR

Grid Incidence at 765/400 kV Pune GIS S/s on 16th December 2015

Event Category: GI-2

Event Date and Time: 16th December 2015, 11:03 Hrs

Event Summary: 2nd Stage gas detector alarm of 400 kV Pune Parli 2 89 A compartment got earthed resulting in its operation causing tripping of 400 kV Main Bus 1 and connected all elements. There was no load/generation loss during the event.

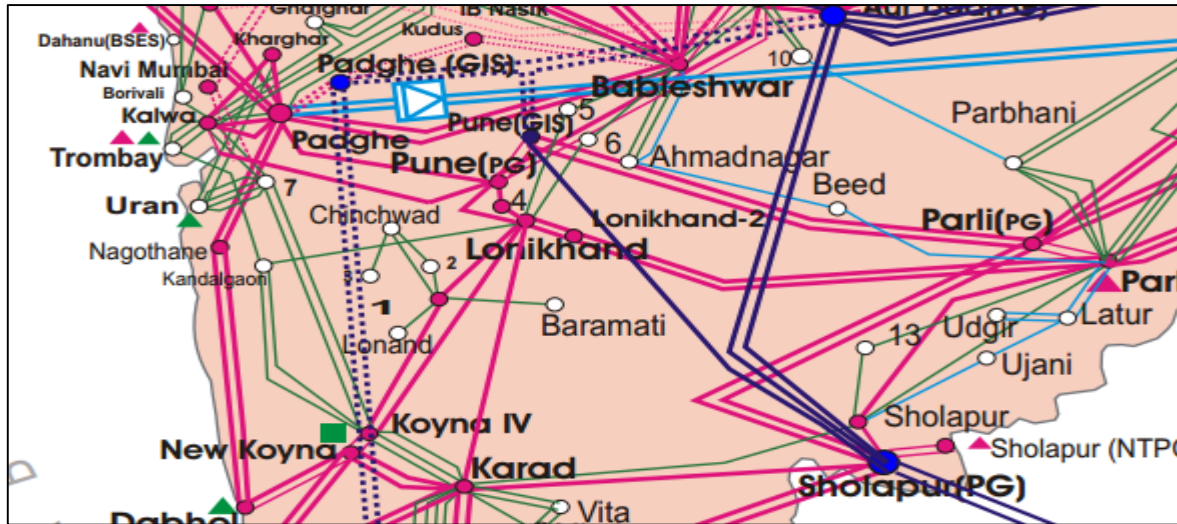
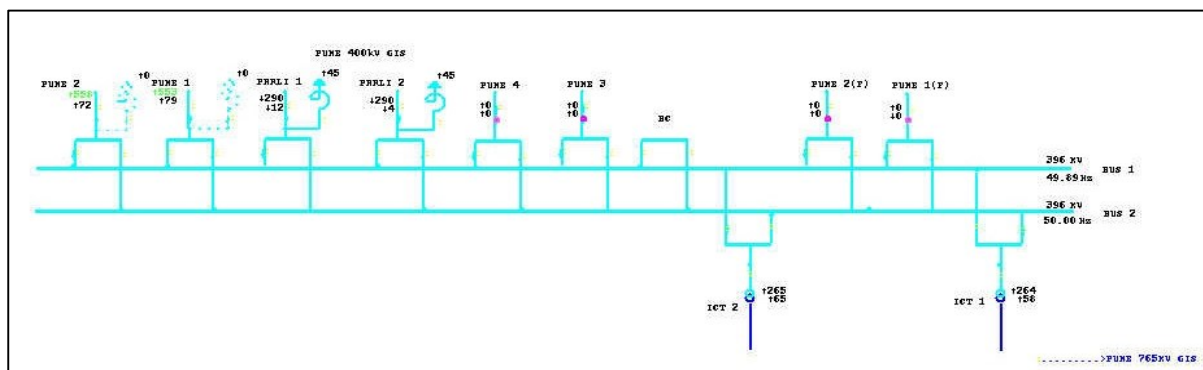
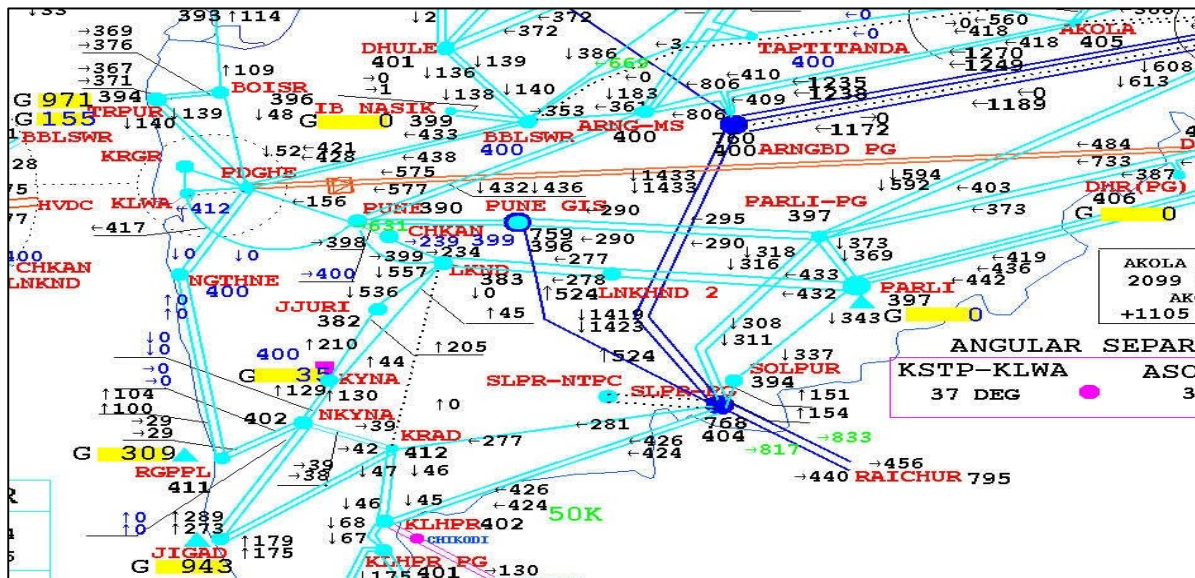
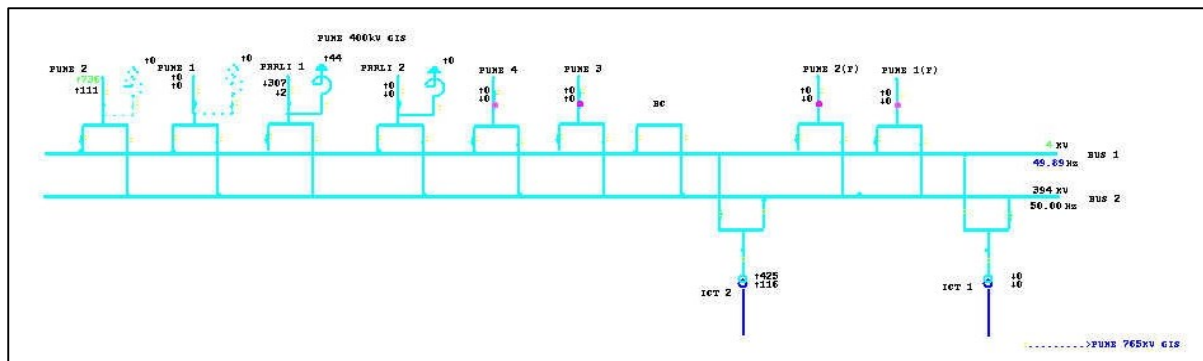
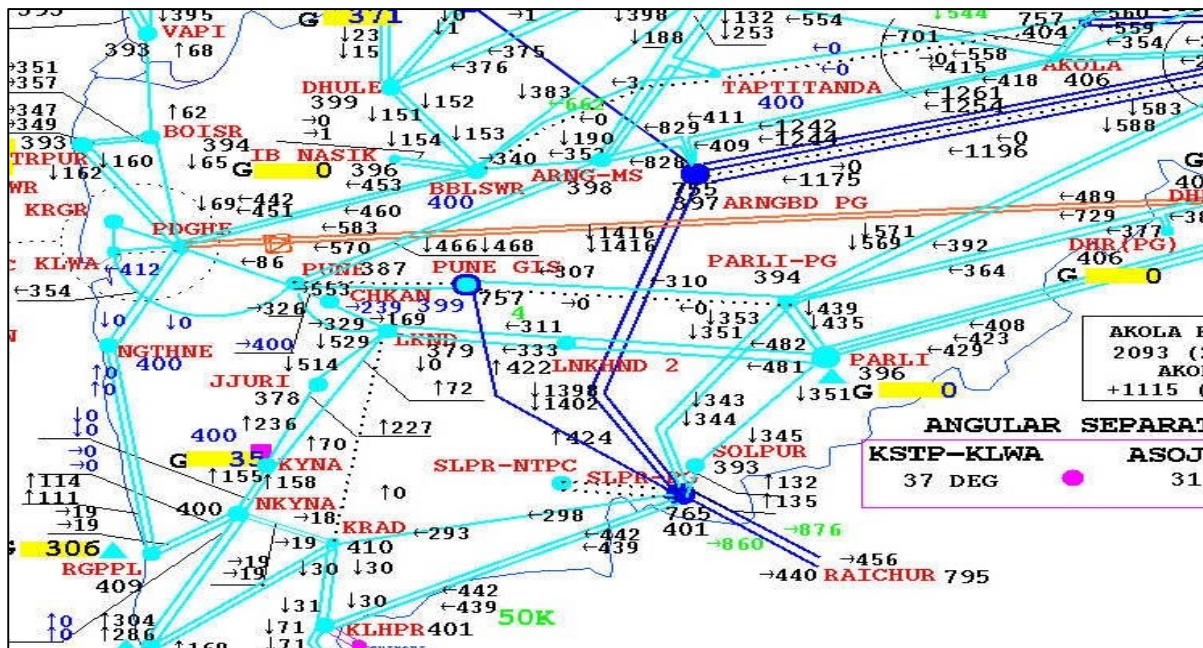


Figure 1 : Geographical Map

Pre Incident Condition at 11:00 Hrs.:



Post Incident Condition at 11:10 Hrs.:



Event Overview: Report received from PGCIL WR-1 is attached. During the event there was no fault in the system.

Event Analysis: The reason for the event was earthing of auxiliary switch 89A of the 400 kV Pune-Parli 2 circuit which was on 400 kV Bus 1. DR of the circuits tripped are attached as annexure.

Recommendation:

- PGCIL WR-1 is requested to carry out the through checking of the GIS sub-station to avoid any such reoccurrences immediately.
- Also, PGCIL WR-1 is advised to send event report in least possible time to WRLDC/WRPC.
- The above incident is one of the first at GIS sub-station so may kindly be discussed in detail in PCM.

Annexure: Report from PGCIL WR-1

POWERGRID CORPORATION OF INDIA LIMITED

REGION : WESTERN REGION - I

SUBSTATION: 765/400kV Shikrapur GIS, Pune

| | | |
|----|--|---|
| 1 | DATE AND TIME OF OCCURANCE | 16.12.2015@ 11:03am |
| 2 | DATE AND TIME OF RESTORATION | 16.12.2015 @ 11:38 Bus Coupler 16.12.2015 @11:39, PuneGIS-Pune CKT # 1 16.12.2015 @ 11:47 Pune GIS-Parli # 2 16.12.2015 @ 11:54, ICT#1 |
| 3 | OUTAGE DURATION | Approx 40 minutes |
| 4 | PARTICULARS OF TRIPPING: | 400kV Bus tripped because of 2 nd stage tripped wire got earthed for GAS DETECTOR of 89A of Pune-Parli#2 |
| 5 | CONNECTION OF LINE/ICT BEFORE OCCURANCE (INDICATE LINE/ICT CONNECTED TO WHICH BUS I.e. BUS NO 1,2 OR TRANSFER BUS | 400kV Bus-1 elements tripped(All elements connected to 400kV Bus-1 |
| 6 | <p>SYSTEM CONDITION IMMEDIATELY BEFORE OCCURANCE</p> <p>a. frequency- 50.19Hz on 400kV, 50.03Hz</p> <p>b Voltage- 396kV, 758kV</p> <p>c. Load MW & MVAR</p> <p>1.400kV PuneGIS-Pune#1 557.91MW/79.1MVAR</p> <p>2.400kV PuneGIS-Pune#2 558.23MW/79.2MVAR</p> <p>3.400kVPuneGIS-Parli#1 - 293.35MW/-4.31MVAR</p> <p>4. 400kV PuneGIS-Parli#2 - 293.42MW/-4.36MVAR</p> <p>5.765kV PuneGIS-Solapur -520MW/-160MVAR</p> <p>6.ICT1. 260MW/83MVAR, ICT2. 259MW/ 75MVAR</p> <p>d. Whether any line / equipments was under maintenance- NO</p> <p>e. Whether any Protection was bypassed / not available.- NO</p> | |
| 7 | Tripping Sequence (Indicate time of Tripping of each Feeder) | All the lines and elements connected to Bus1 tripped at 11:03:43 am |
| 8 | Equipments damage, if any | NIL |
| 9 | Sequence of Normalization | Bus coupler, PuneGIS-Pune CKT # 1, Pune GIS-Parli # 2, ICT#1 |
| 10 | Reasons for Unsuccessful auto re - closure or auto restart. | 2 nd stage alarm of GAS DETECTOR which trips the whole compartment of the respective bus duct. |
| 11 | Analysis a. Cause of occurrence b. Suggestion for improvement. | GAS DETECTOR 2 nd stage wire of Pune Parli#2, 89A compartment got earthed. |
| 12 | ANY OTHER RELEVANT INFORMATION | NIL |
| | | |

Tripping Analysis

| | |
|--|--|
| Line/Element Name | 400kV Bus-1 of 765/400kV Pune GIS |
| Date & time of tripping | 16.12.2015@ 11:03am |
| Type of fault | GAS DETECTOR second stage alarm |
| Fault current | NA |
| Main-1 prot. operation | NA |
| Main-2 prot. operation | NA |
| Other relay operation | PUA & PUB operated for Bus-1 |
| DR triggering (whether analog or digital) | Triggered |
| EL triggering | - |
| PLCC operation | Yes |
| Fault location | 89A SF6 gas compartment of PuneGIS-Parli#2 |
| Main CB operation | YES |
| Tie CB operation | NA |
| Time synchronization | YES |
| A/R operation | NA |
| | |

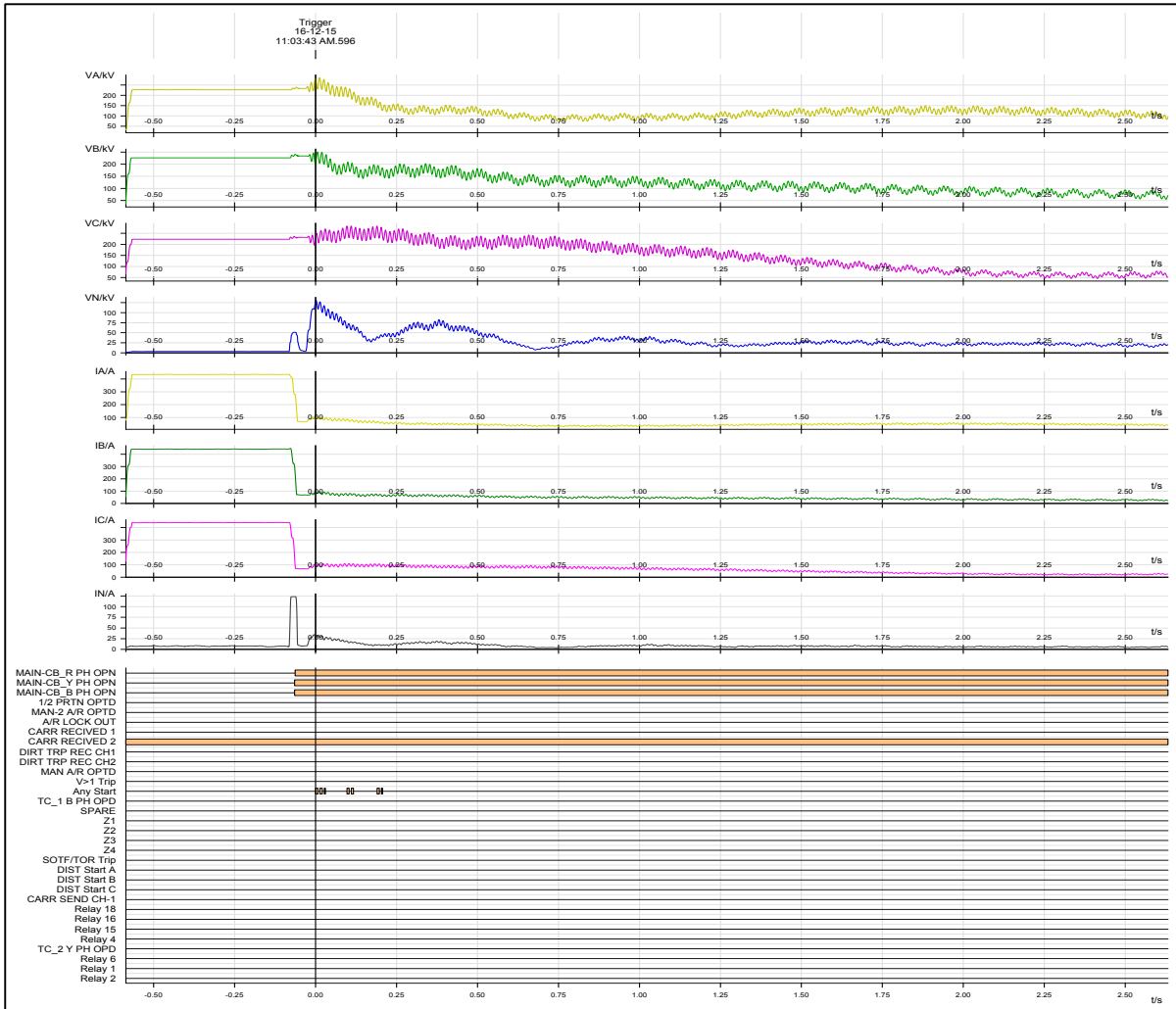


Fig: DR of 400 kV Pune GIS -Parli 2 from Pune GIS end

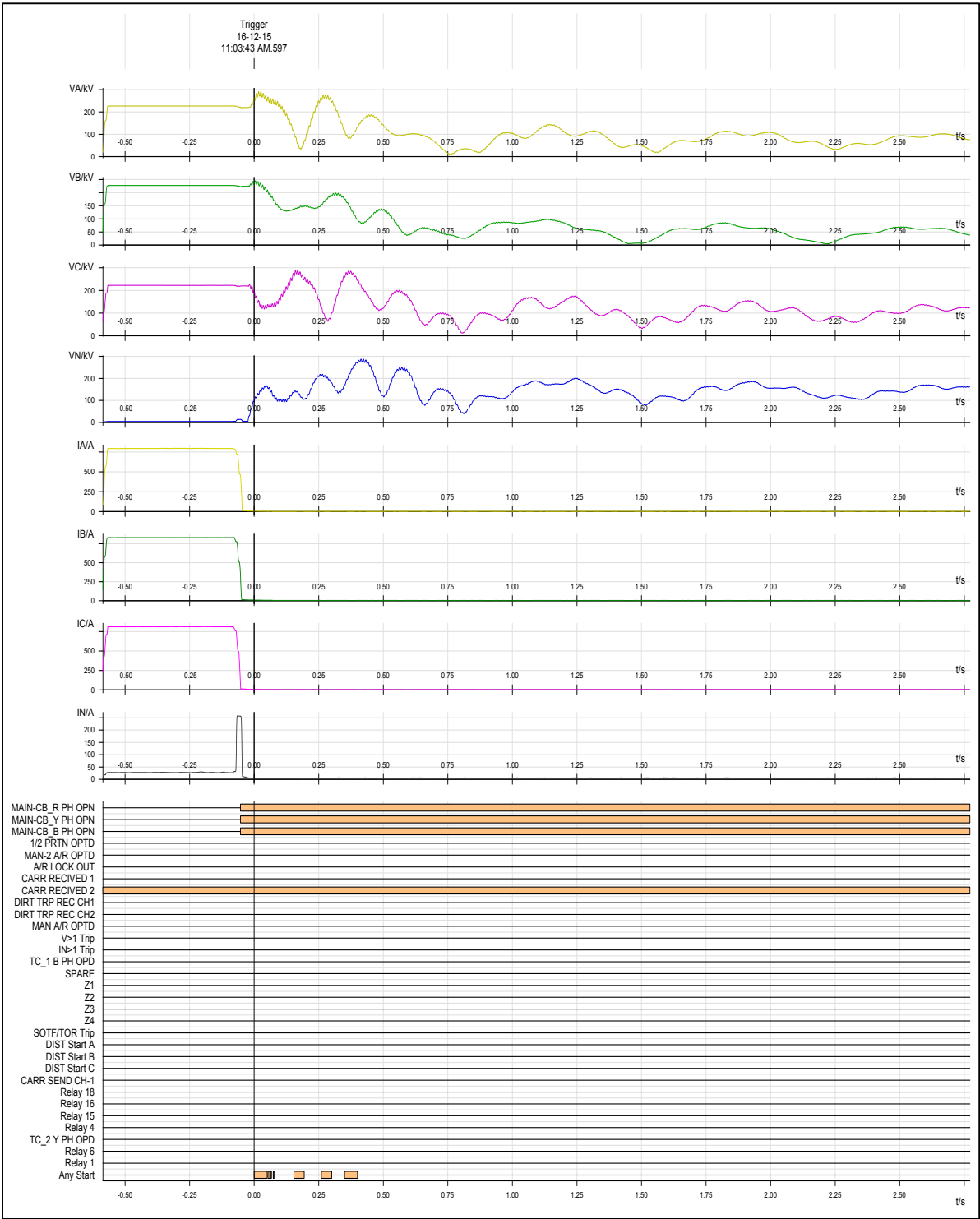


Fig: DR of 400 kV Pune GIS -Pune 1 from Pune GIS end

Grid Incidence at 765/400 kV Sholapur (PG) Sub-station on 2nd January 2016

Event Category: GI-2

Event Date and Time: 2nd January 2016, 18:22 and 19:56 Hrs

Event Summary: At 18:22 Hrs, 765 kV Sholapur-Raichur 2 line reactor tripped on REF protection operation during charging its charging at Sholapur end as a bus reactor after completion of its AMP work (Line was out due to jumper snapping). At the same time 765 kV Aurangabad-Sholapur 1 line reactor at Sholapur end also tripped on REF. This led to high voltage at Sholapur sub-station. After this at 19:56 Hrs, 765 kV Sholapur-Pune 1 and 765 kV Aurangabad-Sholapur 1 circuit tripped on over voltage from Sholapur end. This led to reduction in the system reliability in the area. However there was no further tripping. Lines/reactor were taken immediately after the voltage improvement at Sholapur.

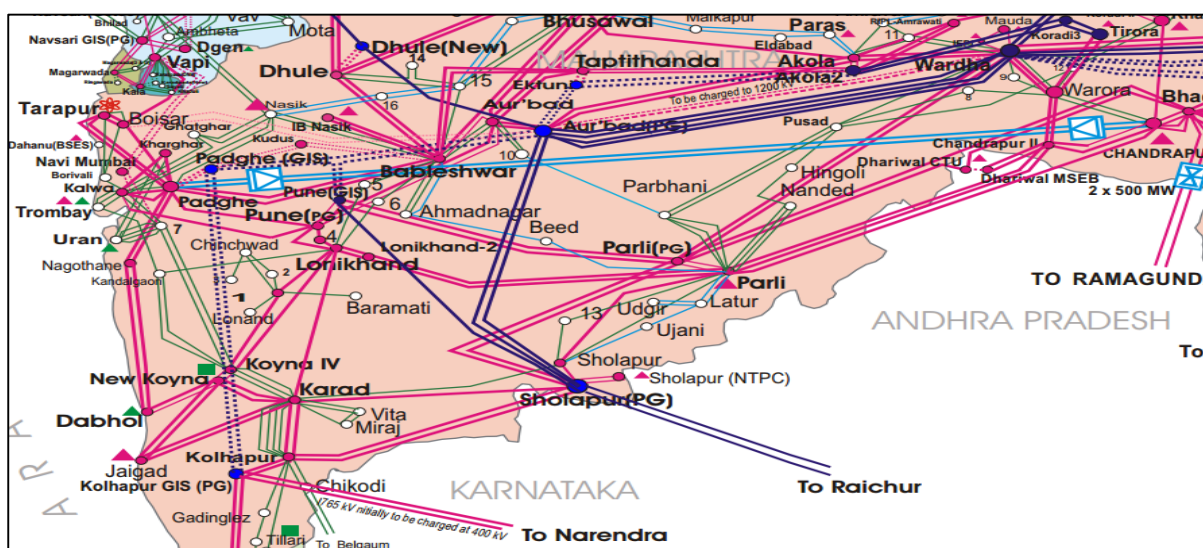


Figure 1 : Geographical Map

Event Overview:

- At 765/400 kV Sholapur sub-station, 240 MVAR switchable Line reactor of 765 kV Solapur – Raichur was made out in the morning at 09:31 for AMP work. Line was already out since 10:46 Hrs due to phase to phase fault on jumper snapping near to Raichur end.
- After completion of the work, the line reactor was made on at 18:11 however it was observed that line got tripped on REF protection. After 10 seconds, the 765 kV Line reactor of Solapur-Aurangabad 1 circuit at Solapur also tripped on REF protection operation. This has resulted in rise in voltage at Sholapur sub-station. SOE from Sholapur sub-station is given below.

| Name of element | Sub-station | Status | Date and Time | Time in ms |
|--------------------------|-----------------------|---------|---------------------|------------|
| Sol7_RAICHUR 1 LR CB | RSCC SHOLAPUR S 400 C | Closed | 02-01-2016 18:11:15 | 851 |
| Sol7_RAICHUR 1 LR CB | RSCC SHOLAPUR S 400 C | Open | 02-01-2016 18:11:53 | 351 |
| Sol7_KV_ARGBD_1_LRCB_SOE | RSCC SHOLAPUR S 400 C | Acted | 02-01-2016 18:22:02 | 96 |
| Sol7_Argbd1_LR_CB | RSCC SHOLAPUR S 400 C | Transit | 02-01-2016 18:22:02 | 98 |

- At 19:56 Hrs, due to high voltage at Solapur, 765 kV Aurangabad-Solapur 1 and 765 kV Pune-Solapur circuit tripped from Solapur end and Direct trip was send to remote end. This resulted in reduction in the voltage at Sholapur and further no tripping occurred on account of high voltage.

| Name of element | Sub-station | Status | Date and Time | Time in ms |
|-------------------------|------------------------|---------|---------------------|------------|
| Sol7_Argbd1_LR_CB | RSCC SHOLAPUR S 400 C | Open | 02-01-2016 18:22:02 | 116 |
| Pune7(GIS)SLPR GRPA SOE | RSCC PUNE 765 KV | Acted | 02-01-2016 19:56:46 | 235 |
| Pune7(GIS)SLPR GRPB SOE | RSCC PUNE 765 KV | Acted | 02-01-2016 19:56:46 | 235 |
| Sol7_Pune M/B CB | RSCC SHOLAPUR S 400 C | Open | 02-01-2016 19:56:46 | 217 |
| Sol7_Pune T/B CB | RSCC SHOLAPUR S 400 C | Open | 02-01-2016 19:56:46 | 219 |
| Pune7(GIS)ICT 2 TCB SOE | RSCC PUNE 765 KV | Acted | 02-01-2016 19:56:46 | 255 |
| Pune7(GIS)SLPR CB SOE | RSCC PUNE 765 KV | Acted | 02-01-2016 19:56:46 | 254 |
| ARG7 SOLPR-1-L 86A OPTD | RSCC AURANGABAD 400 KV | Acted | 02-01-2016 19:56:50 | 45 |
| ARGDB7_SOLPR1_CB | RSCC AURANGABAD 400 KV | Open | 02-01-2016 19:56:50 | 67 |
| ARG7 SOLPR1 TIE CB SOE | RSCC AURANGABAD 400 KV | Acted | 02-01-2016 19:56:50 | 67 |
| ARGDB7_SOLPR1_TCB | RSCC AURANGABAD 400 KV | Open | 02-01-2016 19:56:50 | 67 |
| ARG7 SOLPR-1-L CB SOE | RSCC AURANGABAD 400 KV | Acted | 02-01-2016 19:56:50 | 67 |
| ARG7 SOLPR-1-L 86B OPTD | RSCC AURANGABAD 400 KV | Acted | 02-01-2016 19:56:50 | 45 |
| Sol7_Argbd1_TIE_CB | RSCC SHOLAPUR S 400 C | Transit | 02-01-2016 19:56:51 | 235 |
| Sol7_Argbd1_CB | RSCC SHOLAPUR S 400 C | Open | 02-01-2016 19:56:51 | 257 |
| Sol7_Argbd1_TIE_CB | RSCC SHOLAPUR S 400 C | Open | 02-01-2016 19:56:51 | 256 |
| Sol7_Argbd1_CB | RSCC SHOLAPUR S 400 C | Transit | 02-01-2016 19:56:51 | 235 |

- This has resulted in reduction is system reliability to non-availability of various lines. However voltage at Sholapur has reduced and no further tripping occurred in the area.

Table 1 : Sequence of events

| Elements | Tripping Time | Relay Indication at End 1 | Relay indication at End 2 | Restoration Time |
|--|---------------|-----------------------------------|---------------------------|------------------|
| 765 kV Sholapur-Raichur LR @ Sholapur end (Charged as Bus reactor) | 18:22:02.096 | REF protection | | 21:03 Hrs |
| 765 kV Aurangabad-Sholapur 1 LR @ Sholapur end | 18:22:02.096 | REF protection | | 03-01-2016 07:11 |
| 765 kV Sholapur-Pune | 19:56:46.229 | Overvoltage stage 1 trip, DT send | Tripped on receipt of DT | 21:26 |
| 765 kV Aurangabad-Sholapur 1 | 19:56.50.031 | Overvoltage stage 1 trip, DT send | Tripped on receipt of DT | 03-01-2016 07:11 |

* Based on WRLDC SCADA SOE/PMU

Event Analysis:

- Reason for tripping of both line reactors has to be furnished by the PGCIL WRTS-1. The simultaneous tripping reflect some issue with the auxiliary bus which need to be confirmed from the sub-station. **PGCIL WRTS -1 is requested to share the details of the event and the corrective action taken afterwards.**

- The tripping of line on overvoltage has occurred as per the setting. The voltage of Sholapur can be observed to be high from the voltage plot as shown in figure 2.

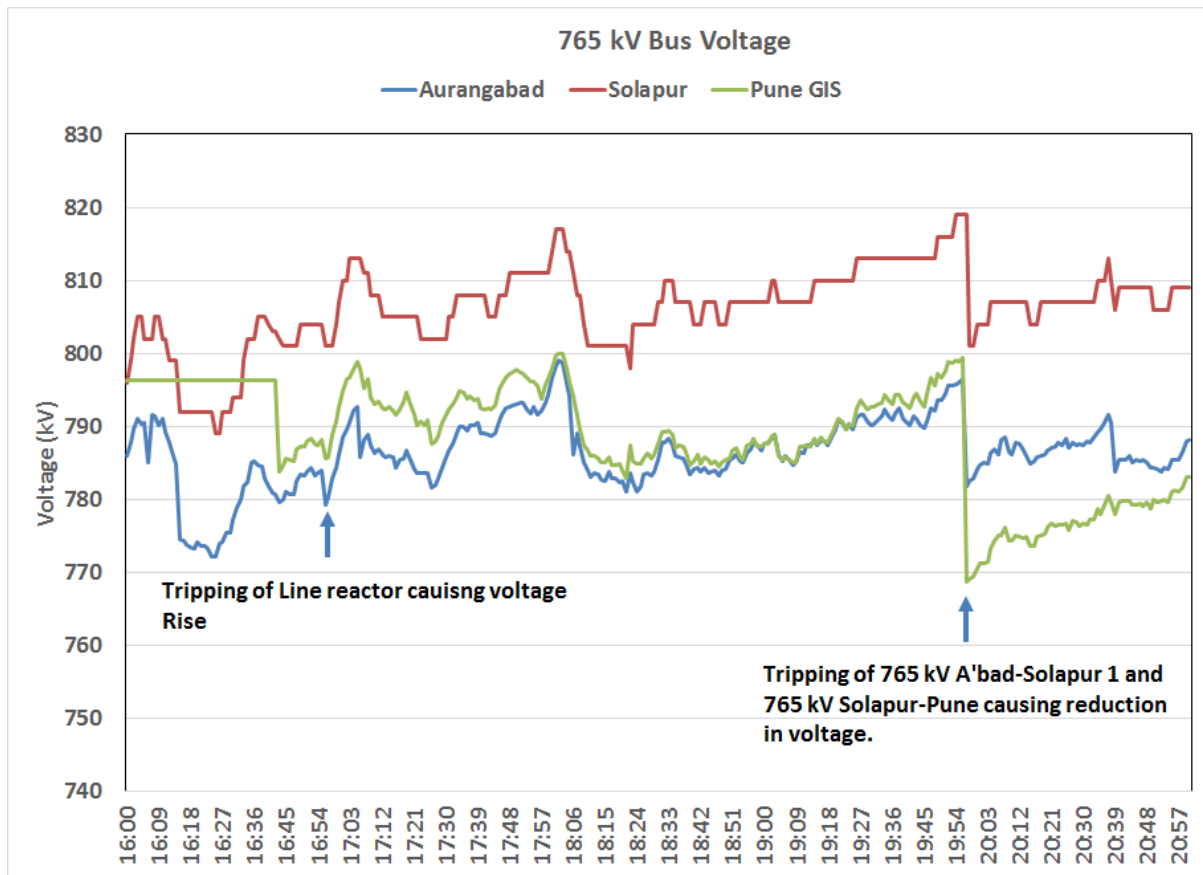


Figure 2 : Voltage of 765 kV Sholapur, Aurangabad and Pune from WRLDC SCADA

Remarks:

- PGCIL WRTS-1 is requested to kindly share the reason for the tripping of both the reactor on REF protection with WRLDC/WRPC. Also the corrective action taken afterwards may also be shared.
- Also, PGCIL WRTS-1 is again advised to share the DR and event logger for the tripping with WRLDC/WRPC with 24 Hours as per the regulation. WRLDC has received the DR/EL from the remote end sub-station for this event but DR from Sholapur end was not received.

Grid Incidence due to Tripping of 765 kV Aurangabad-Sholapur 1 & 2 on 1st March 2016

Event Category: GI-2

Event Date and Time: 1st March 2016, 22:05 Hrs.

Event Summary: On 1st March 2016, 765 kV Aurangabad-Sholapur D/C tripped on Fault at 22:05 Hrs. This has resulted in loading of parallel 400 kV networks. Further, the voltage in the Maharashtra's system has reduced considerably due to the tripping of these circuits. It was observed that the largest angular separation in the Indian grid has crossed 100 degrees from initial 77 degrees due to these tripping. This event was of serious concern however with system operator's actions the event has been contained. There was no load/generation loss during the event.

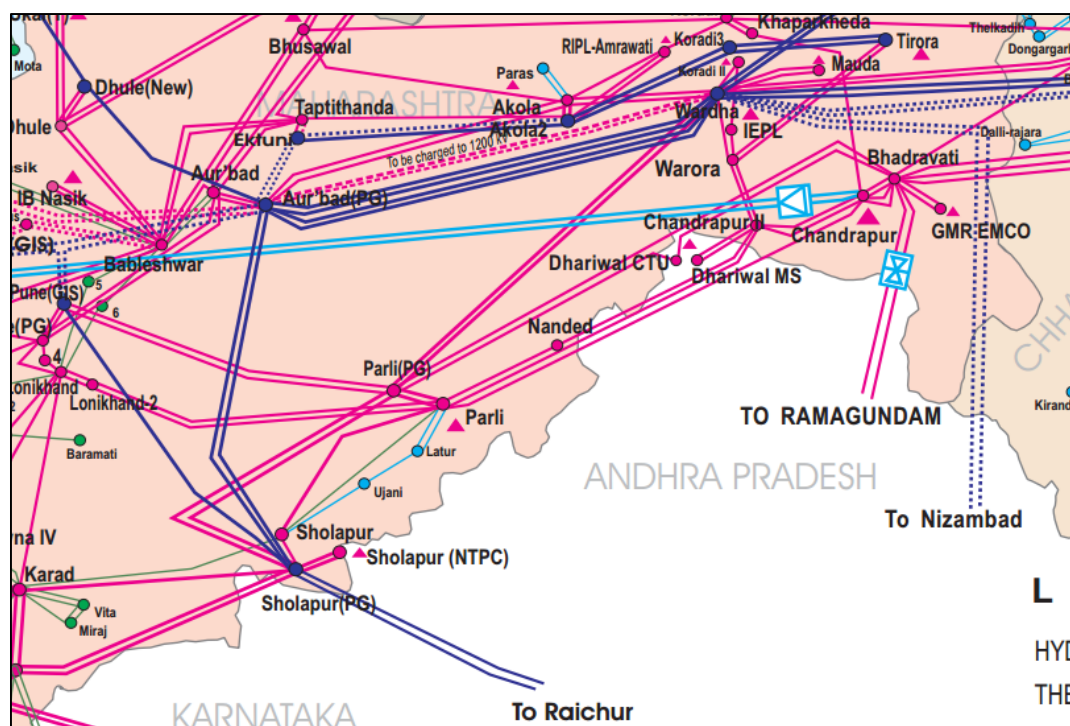


Figure 1 : Geographical Map

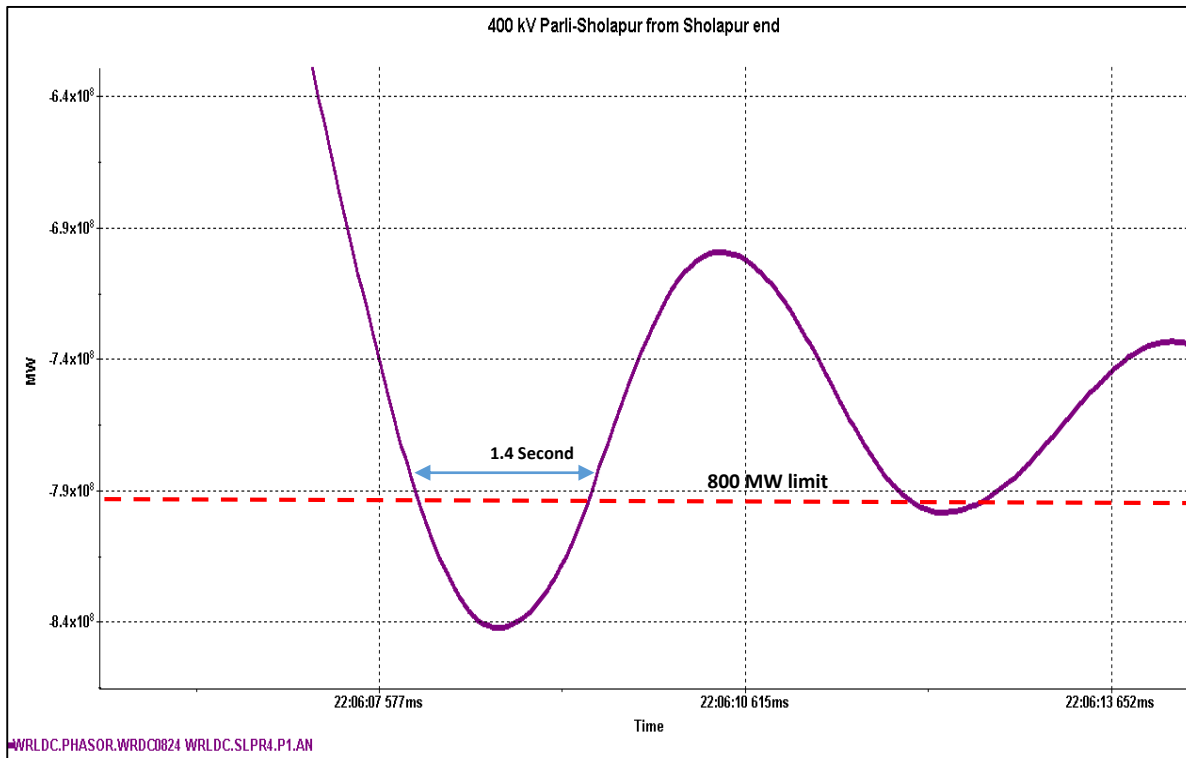
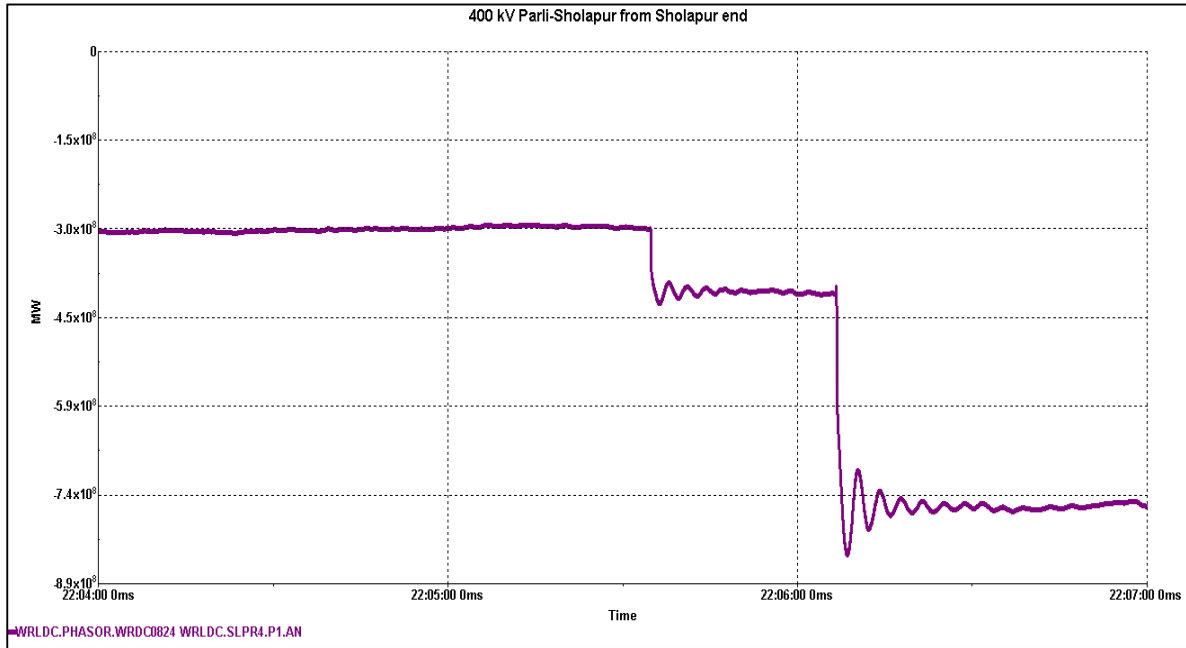
Event Analysis: In the 765 kV Aurangabad-Sholapur D/C, Auto-reclosure facility was not enabled due to absence of Neutral grounding reactor for line reactors at Sholapur end. These circuits carries large amount of power to transfer to Western Maharashtra and Southern grid.

- At 22:05 Hrs, 765 kV Aurangabad-Sholapur 1 tripped on R Phase to E/F and at 22:06 Hrs 765 kV Aurangabad-Sholapur 2 tripped on B phase to E/F. As there was no NGR so A/R was in disabled on these circuit and no attempt for A/R was taken by the protection system. With these both circuits tripped. The PMU plots attached as a part of NLDC report in annexure.
- This has resulted in sudden increase in Power to the remaining parallel 400 kV links in the corridor however no SPS has operated for the contingency as lines were below their limits.
- The Angular separation in the Grid has changed from 77 degrees to 110 degrees and got stabilized at 100 degrees as shown in the NLDC report attached as annexure.
- The reason for the various SPS non-operation is provided in the next section.

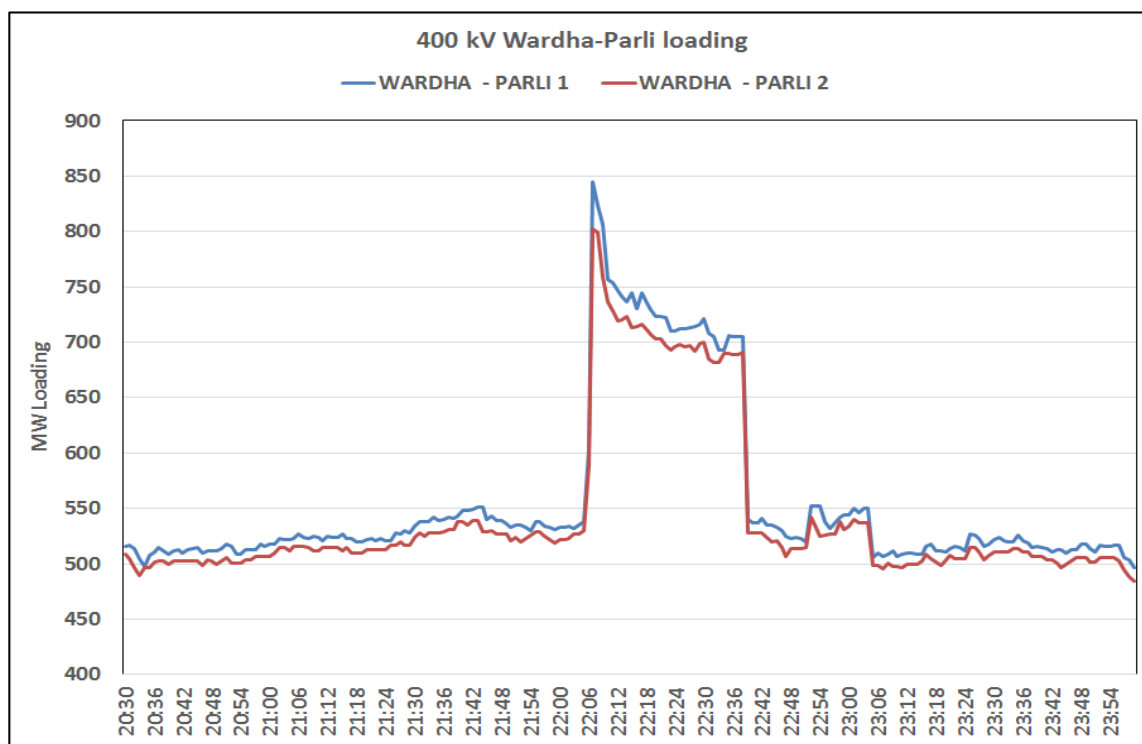
- Immediate steps were taken by NLDC/WRLDC/SRLDC to control the loading on the 765 kV Sholapur-Raichur 1 & 2 for secure grid operation. Further, 765 kV Sholapur-Aurangabad 1 was taken back in service at 22:38 and 765 kV Sholapur-Aurangabad 2 at 23:03 Hrs.

Observation and Details from WRLDC

1. **Non-Operation of 400 kV Parli-Sholapur (SPS-6):** 400 kV Parli-Sholapur SPS is to operate if line flow is more than 800 MS for 2.5 Seconds. In the present case the same was above this value only for 1.4 Seconds that's why it did not operate.



2. **Non-Operation of Auto-Reclosure operation on 765 kV Aurangabad-Sholapur D/C:** As it has been informed that due to non-availability of NGR on the Line reactors at Sholapur end for these circuits the A/R has been disabled. The A/R on these circuits were taken in service on 8th March 2016.
3. **Non-Operation of SPS for 400 kV Wardha-Parli D/C (SPS-5):** The SPS is designed for Flow on either circuit of 400 kV Wardha-Parli D/C (sensed at Wardha) crossing 850 MW and remaining above this value for 2.5 seconds. As the flow was below 850 MW so the SPS has not operated.



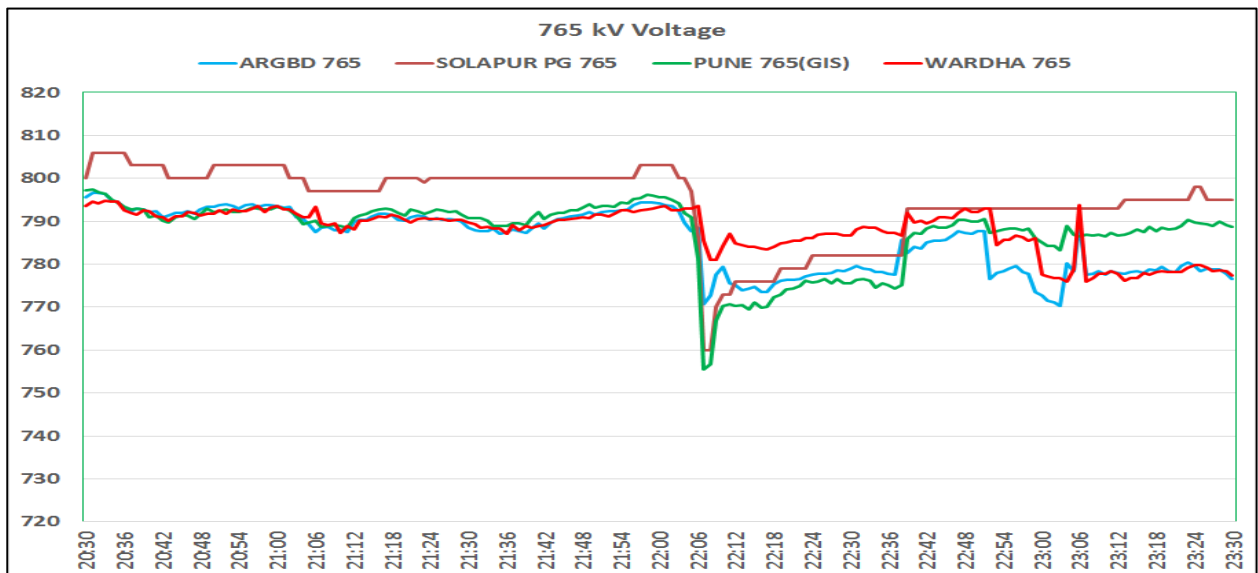
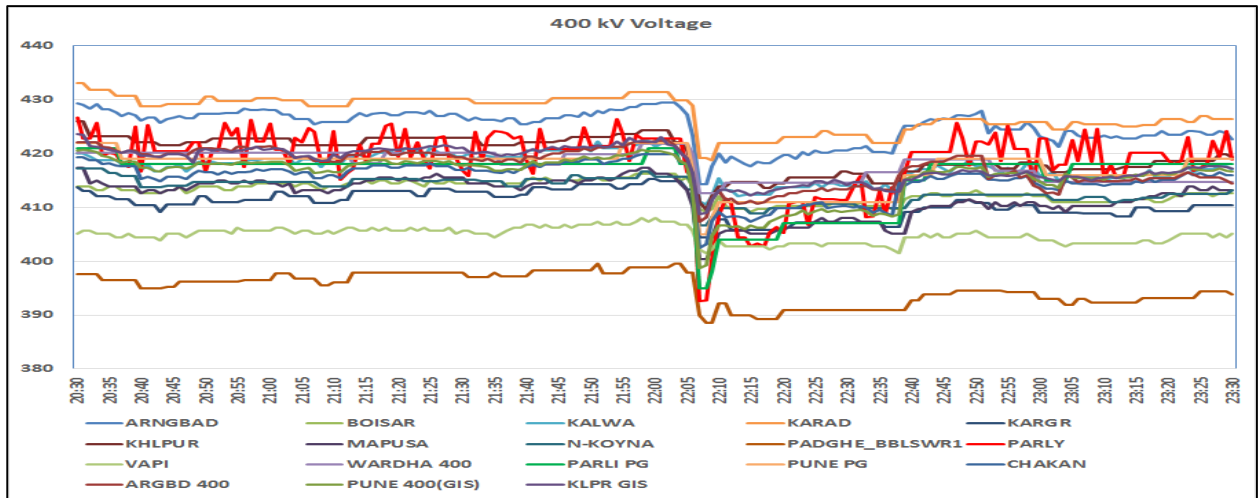
4. **Non-Operation of 765 kV Aurangabad-Sholapur SPS (SPS-8):** The SPS is set to operate for loss of Import at Sholapur on 765 kV Aurangabad-Sholapur D/C by 2500 MW due to tripping of these lines. As the line was carrying 2100 MW prior to tripping which is below 2500 MW , so SPS has not operated.
5. **Voltage Condition in the grid before and After Trip and UVLS scheme :** Load trimming at Padghe, Lonikhand, Parli, Babeshwar and Jejuri with setting 370 kV and Definite time delay of 5 second. As the event occurred during offpeak period in night and voltage were high, so none of the voltage touched the 370 kV limit. However if the same have occurred in peak hour, then the load trimming scheme at Parli (MS) would have operated.

During visit to Parli, it was intimated that this UVLS scheme has picked on 9th Feb'16 when 765 kV A'bad-Sholapur 1 tripped on fault while other line was under shutdown during at 07:59 Hrs.

| Sub-Station | At 22:00 | At 22:08 | Voltage Drop |
|----------------|----------|----------|--------------|
| Aurangabad(MS) | 429.15 | 414.24 | 14.91 |
| Boisar | 416.18 | 409.15 | 7.03 |
| Kalwa | 421.29 | 410.48 | 10.81 |
| Karad | 431.41 | 419.2 | 12.21 |

| | | | |
|------------------------|--------|--------|-------|
| Khargar | 415.21 | 404.41 | 10.8 |
| Kolhapur(MS) | 424.36 | 409.63 | 14.73 |
| Mapusa | 416.18 | 400.36 | 15.82 |
| New Koyna | 415.71 | 406.66 | 9.05 |
| Padghe | 398.83 | 388.55 | 10.28 |
| Parli(MS) | 422.78 | 392.75 | 30.03 |
| Vapi | 407.98 | 401.53 | 6.45 |
| Wardha | 421.81 | 412.64 | 9.17 |
| Parli(PG) | 421 | 395 | 26 |
| Pune (PG) | 422 | 405 | 17 |
| Chakan | 419.93 | 403.15 | 16.78 |
| Aurangabad (PG) | 422.41 | 408.15 | 14.26 |
| Pune GIS | 420.4 | 399.29 | 21.11 |
| Kolhapur GIS | 422.06 | 408.94 | 13.12 |
| 765 kV Aurangabad (PG) | 794.2 | 772.76 | 21.44 |
| 765 kV Sholapur (PG) | 803 | 760 | 43 |
| 765 kV Pune GIS | 795.67 | 756.63 | 39.04 |
| 765 kV Wardha GIS | 793.42 | 781.06 | 12.36 |

*Voltage Data of 400 kV Sholapur(PG), 400 kV Jejuri, 400 kV Lonikhand were not updating.



Remarks:

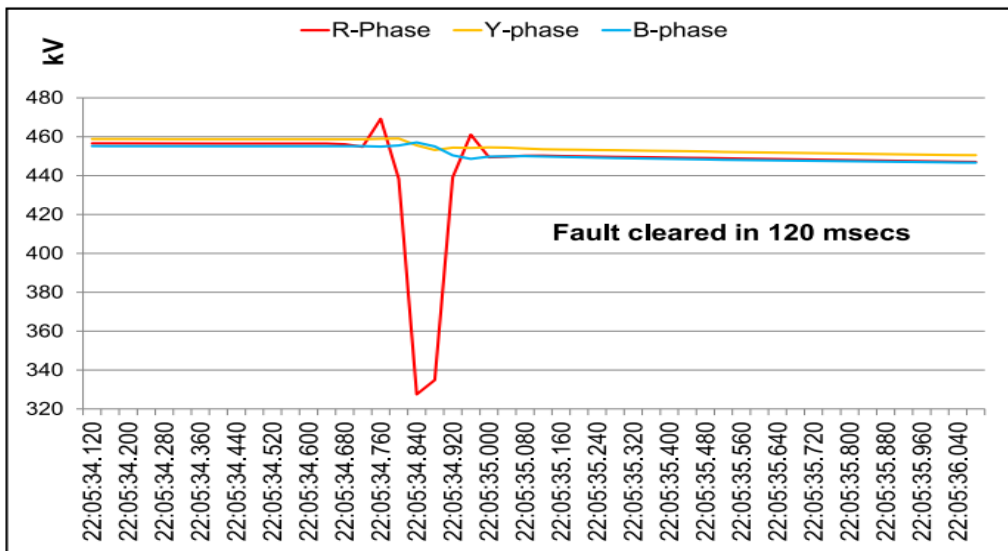
1. As of now no report and details on the tripping of these lines, fault location, reason for faults, Disturbance recorder files has been received at WRLDC. PGCIL WR-1 is advised to submit the complete details on these lines tripping. Non-submission of details comes under the non-compliance of IEGC 5.2.r and CEA grid standard 15.3. Such event are of high severity and incomplete information is not desirable from the utility. PGCIL WR-1 is advised to send such event analysis to WRLDC on protectionwrldc@gmail.com as discussed in the Western region PCM forum.
2. The cause of simultaneous fault on the circuits need reasoning in order to avoid such event in future.
3. There was a considerable delay of around 5 months in talking the auto-reclosure on these circuits from its first charging date after commissioning of NGR at Sholpaur end. The A/R on these circuits were taken first time in service on 8th March 2016.
4. It can be observed that the circuits got sustained after the trial attempt taken which suggest the transient nature of fault on these circuits. If A/R would have been on these circuits since its first time charging then the above double circuit tripping could have been avoided. In view of this it is suggested that any new transmission lines should always come with its auto-reclosure scheme as it will enhance the availability of line and help grid operators in not facing the above scenario.

Annexure: NLDC Preliminary report on the incident

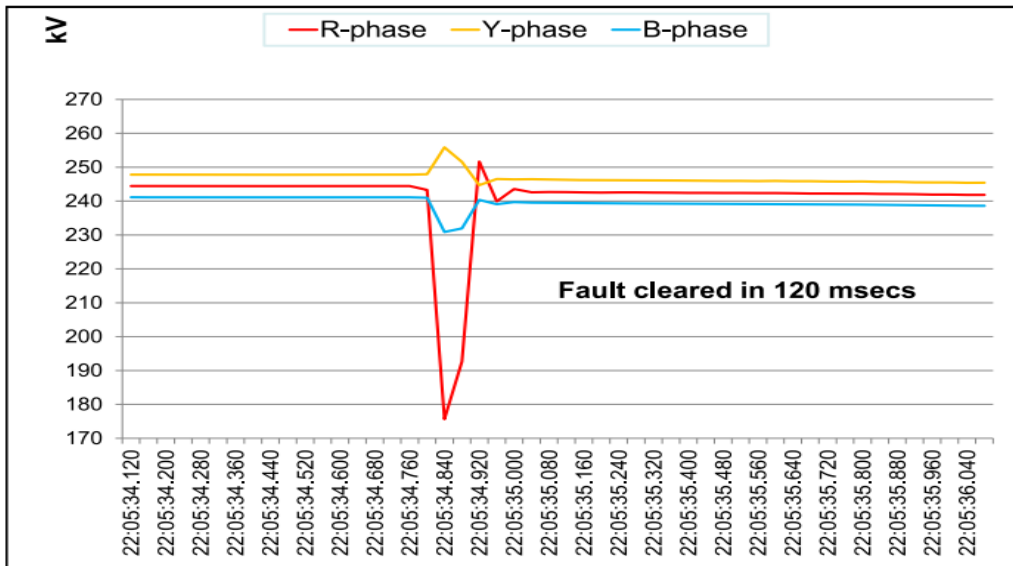
Incident

- On 01.03.16, at 2205 hrs, 765 kV Aurangabad-Solapur-I tripped on R-N Fault and at 2206 hrs, circuit-II tripped on B-N Fault. After tripping of Circuit-I the flow on Circuit-II crossed 2000 MW before tripping.
- The voltage at 765 kV Solapur and Aurangabad was within 800 kV prior to tripping.
- The flow prior to tripping of lines was 1200 MW/circuit.
- In the tripping no signature of AutoReclose was observed and non operation of autoreclose is a cause of concern. PMU has captured both the faults and faults got cleared in time.
- Due to the tripping flow on 400 kV Wardha-Parli D/c crossed 800 MW per circuit.
- The flow on 400 kV Parli-Solapur D/c crossed 830 MW per circuit.
- The angular separation between Thrissur and Vindhyachal crossed 110 degrees which was initially 77 degrees.
- In a week, there are four no. of incidents in 765 kV Aurangabad-Solapur D/c and every time there was phase to ground fault causing tripping of the line.
- 765 kV Aurangabad-Solapur-1 & 2 were taken at 22:38 hrs. and 23:02 hrs.
- 400 kV Parli-Solapur D/c crossed 800 MW/circuit and since **SPS** is designed to operate after 2.5 secs of line flow crossing 800 MW, it is important to check the line flow during that period. The line flow data of the period was intermittent at NLDC PMU so WRLDC is requested to verify if SPS condition was satisfied or not. However no Load relief was observed in SR at that time.

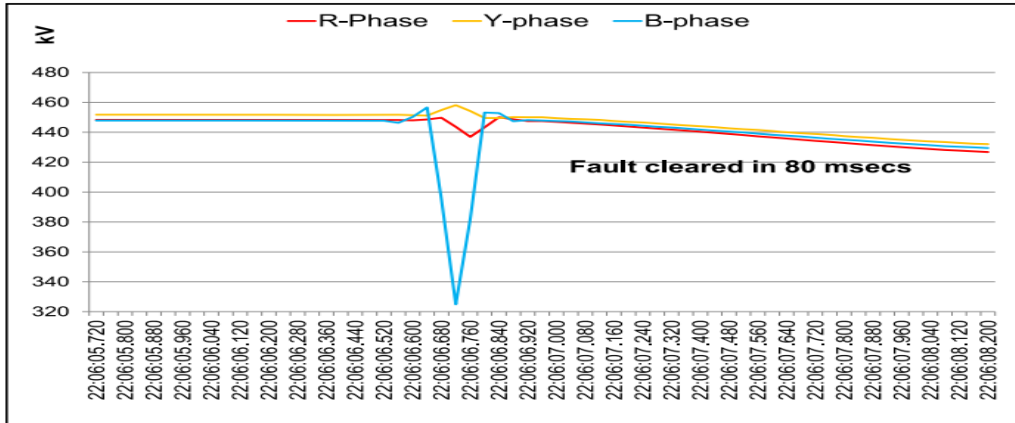
R-N Fault captured in Solapur PMU (765 kV A'bad-Solapur-I tripping)



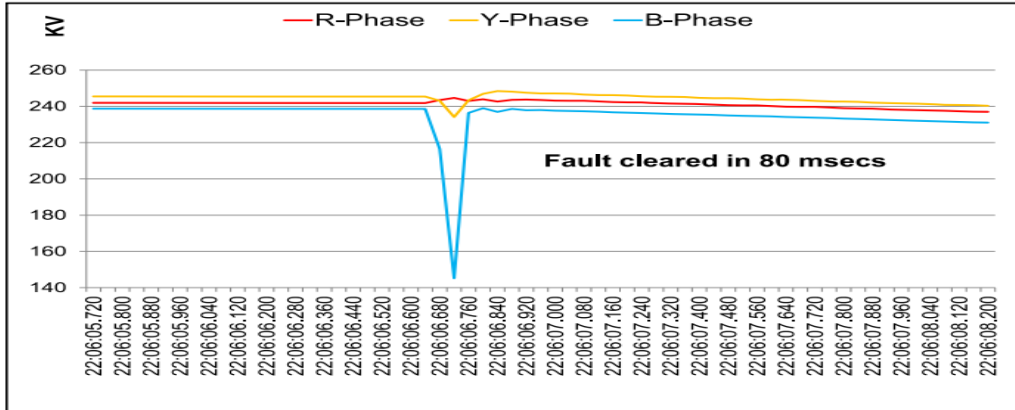
R-N Fault captured in Aurangabad PMU (765 kV A'bad-Solapur-I Tripping)



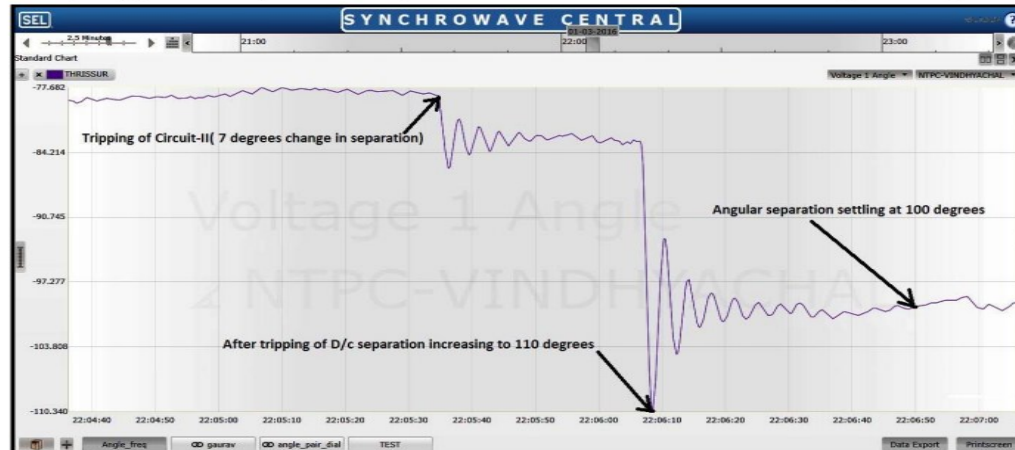
B-N Fault captured in Solapur PMU (765 kV A'bad-Solapur-II tripping)



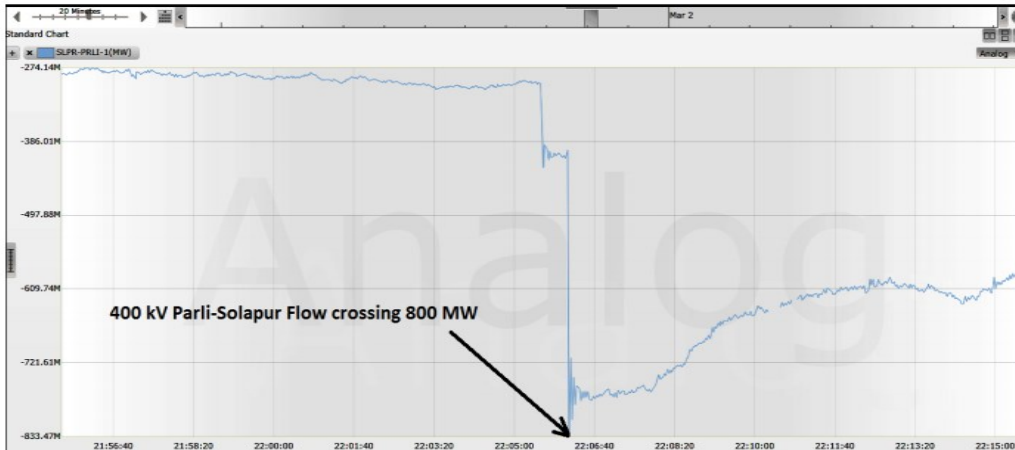
B-N Fault captured in Aurangabad PMU (765 kV A'bad-Solapur-II tripping)



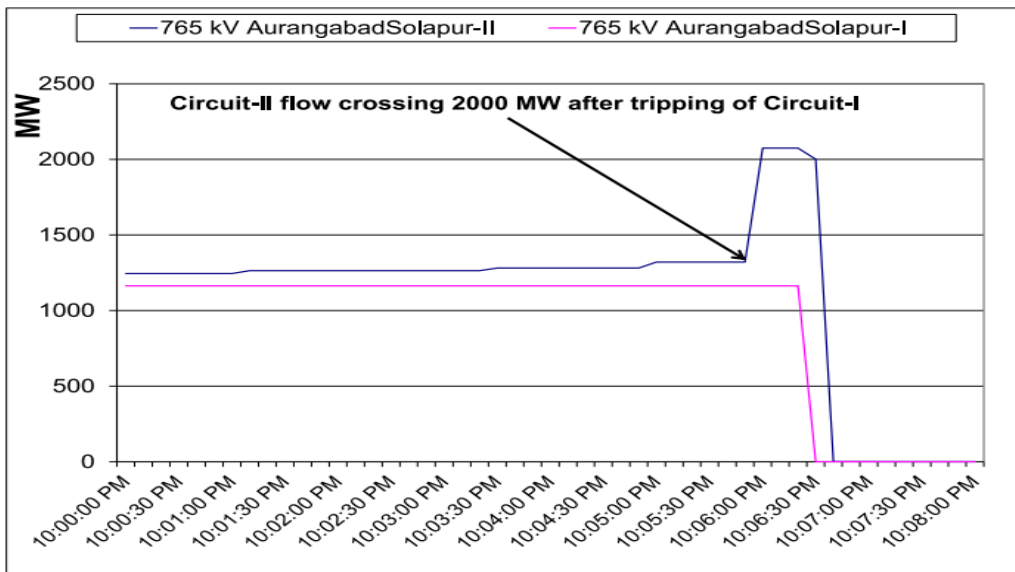
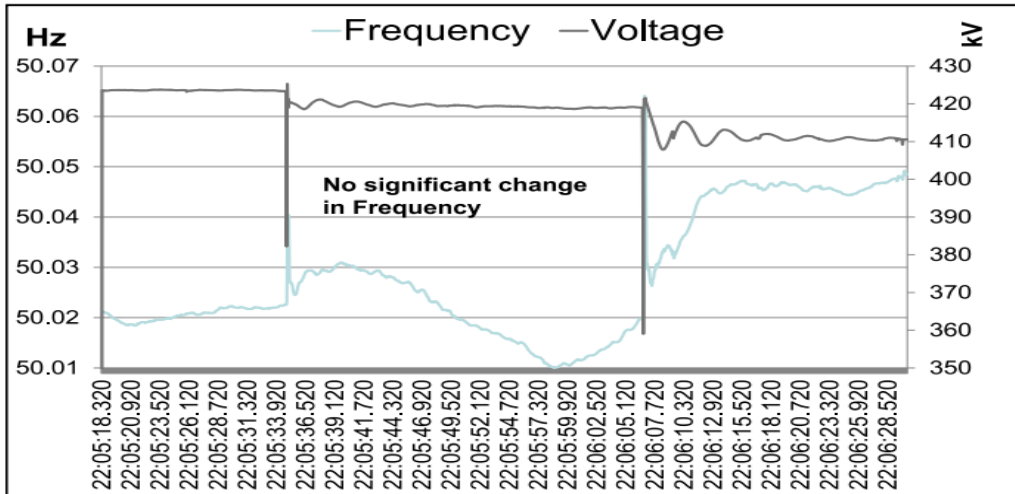
Angular Separation (Thrissur w.r.t. NTPC Vindhyachal)

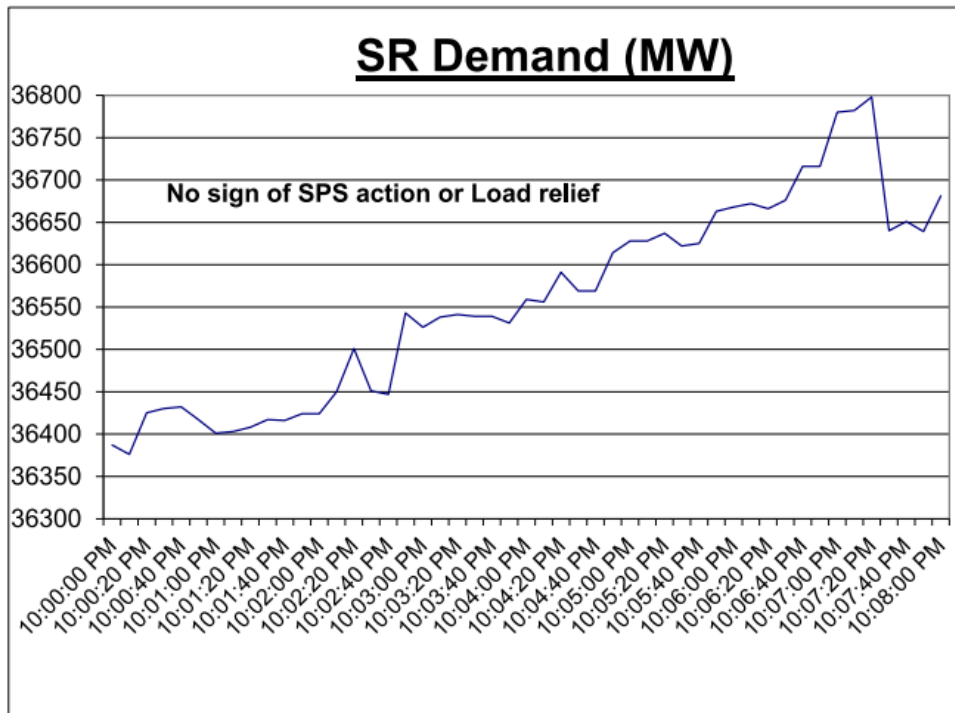
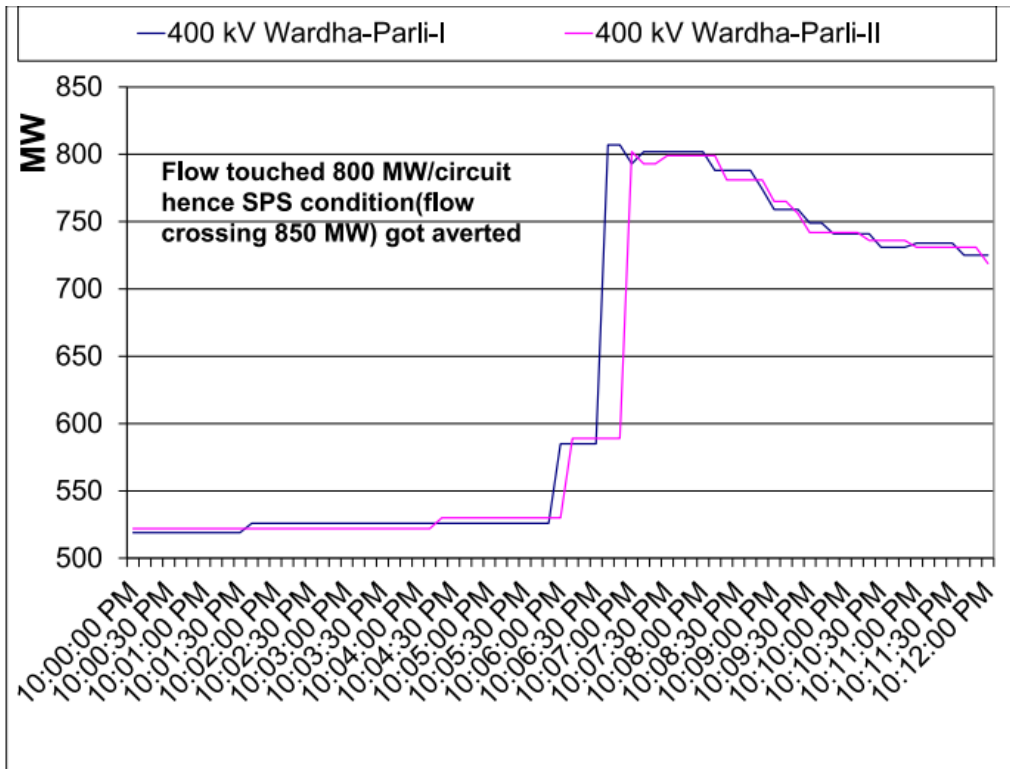


Power Flow of 400 kV Parli-Solapur (SPS criteria satisfied ?)



Frequency Variation with Voltage





Grid Incidence at 400/220/100 kV Kalwa S/s on 11th March 2016

Event Category: GI-1

Event Date and Time: 11th March 2016, 02:25 Hrs.

Event Summary: At 02:25 Hrs, 220/22 kV 50 MVA ICT 1 of CGPL Make at 220/100 kV Kalwa substation caught fire and tripped on Differential Relay and Buchholz/PRV trip operation. Due to fumes, flame and fire in the ICT, the adjacent 220 kV Kalwa-AKP bay R-phase wave trap also burnt and uncoiled, creating R phase to Earth fault in the system. The fault on line due to wave trap burning was sensed at Kalwa in Zone 1 and operated correctly however R pole restriking has occurred causing LBB operation after 200 ms. This led to tripping of 220 kV Bus section 2 and connected elements on LBB operation of the circuit which extended trip command through Bus bar protection. Further, Due to fumes, flame and fire, the conductor between 220 kV dummy tower outside switchyard terminating on 220 kV gantry got melted and after getting broken it rested on 100 kV Bus Y and B Phase. This has created 100 kV bus fault at 220/100 kV Kalwa S/s. All the 100 kV feeders connected to creek side tripped on operation of bus bar protection at 220/100 kV Kalwa S/s. During the incident, 400/220 kV 500 MVA ICT 1 at 400/220 kV Kalwa S/s also tripped due to burning of control cables in 220/100 kV switchyard (ICT is having arrangement that it can be taken in 220 kV bay of 220/100 kV S/s or 400/220 kV S/s).

During the event, high fault current was observed in tune of 47.8 kA along with severe voltage dip (B phase voltage reduced from 247 kV to 126 kV) which causes load throw off. Further, the LTS scheme has also operated due cable shorting during the event which resulted in additional load shed.

Event Analysis: A detailed report on this event is provided by MSETCL which explains the complete incident in phase wise manner. Based on report, DR and PMU it is observed there were four events. The timing provided by the MSETCL in the report and as observed from the Synchrophasor are not matching indicating issue of time synchronization at Kalwa. However the timeline of event are correct indicating a drift in the time synchronization at the site which need to be reset.

Event 1: that first fault was initiated in the 220/22 kV 50 MVA ICT in B phase. Further there is also dip in R phase which may be due to fire in bushings. This fault was quite severe as fault current was of order 47.8 kA and observed voltage dip in R phase Bus voltage at 400 kV Kalwa was from 247 kV to 126 kV. Also a sudden shoot up in frequency (49.924 to 49.996 Hz) is observed as shown in figure 1 which is attributed to stalling of Inductive loads as the Area is load concentrated. Such cases of load drop has been observed in past during fault at Kalwa and Padghe in the past.

Event 2: Further, after the 2.2 seconds of first event, subsequent fault appeared on adjacent 220 kV Kalwa-AKP (Airoli Knowledge Park) feeder where R-phase wave trap got burnt and uncoiled creating R phase to earth fault in the system. Distance protection operated from both ends and issued three phase trip however at Kalwa end the R phase restrike causing LBB operation of bus bar 2. This time

fault current was of the order 49.06 kA exceeding short time current rating (40kA) of CB. While at the AKP end, the relay sensed the wave trap fault in zone 2 for 297 ms and after this fault in Y phase also appeared which reset the R phase and thus the fault of R-Y to earth got isolated after 450 ms. While the 220 kV Kalwa-Apta circuit tripped from Apta end on Backup protection after 350 ms of the fault.

Event 3: After 7 minutes of this event, the fumes and fire has resulted in damage to the burning of control cables in trenches, DC grounding /mixing, the LTS trip relay of 400 kV ICT load trimming scheme at 220 kV Kalwa s/s operated. This has affected the power supply at 220 kV Colourchem s/s (80MW), 100 kV Vashi s/s (54MW), 100 kV NOCIL s/s (46MW) and 22kV feeder (27MW) at Kalwa. Total load loss during this event was 207 MW. This can be seen as rise in the frequency plot at event 3 shown in figure 1. The frequency rose from 50.029 to 50.0885 Hz.

Event 4: The fumes and fire got spread resulting in the damage to the conductor between 220 kV dummy towers outside switchyard terminating on 220 kV gentry causing its melting. This event occurred after 10 minutes of the first event. This has led to breaking of the same and which fell and rested on the 100 kV bus on its Y & B Phase creating 100 kV Bus fault at Kalwa S/s. With this all 100 kV elements from 220/100 kV Kalwa tripped.

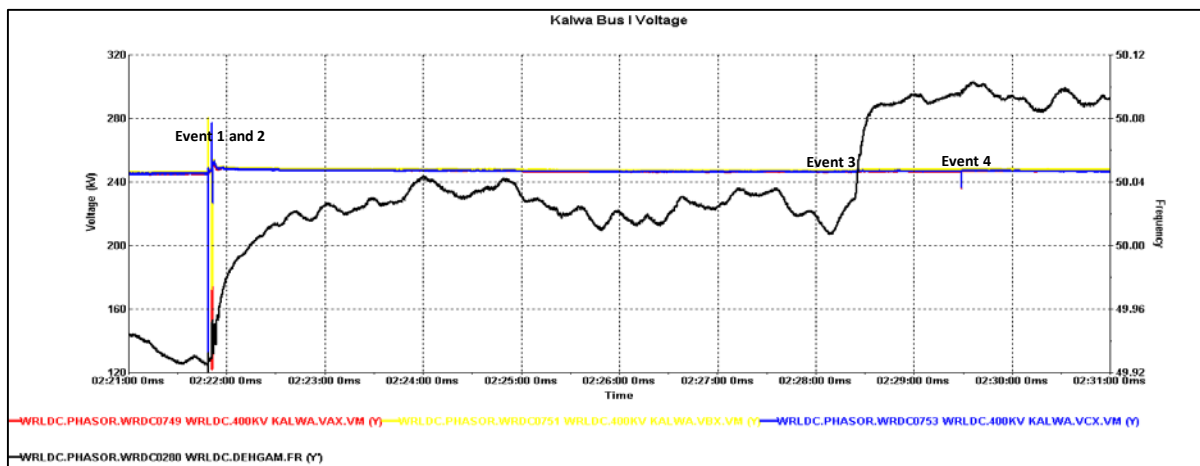


Figure 1 : Kalwa Bus voltage and frequency indicating four events.

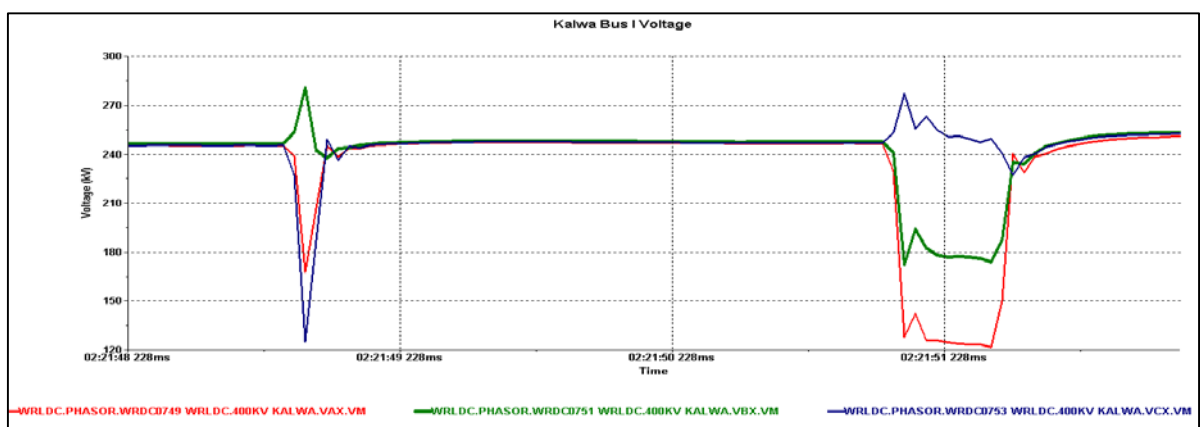


Figure 2 : Kalwa Bus voltage during Event 1 and Event 2. Event 2 shows delayed fault clearance.

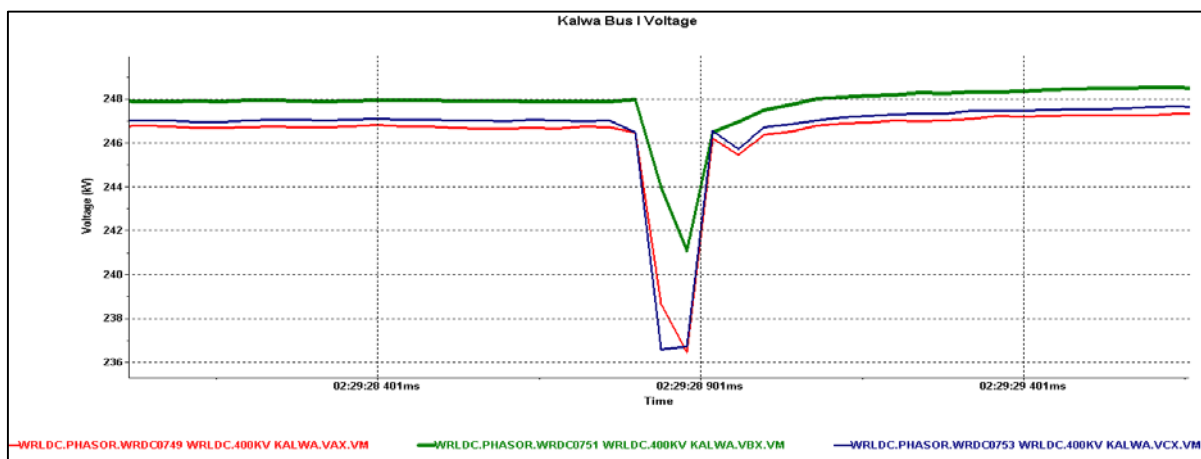


Figure 3 : Kalwa Bus voltage during Event 4.

Apart from these, the 500 MVA, 400/220kV ICT-1 tripped at 400kV s/s due to DC mixing i.e. burning of control cables in switchyard due to transformer fire. The above ICT is having 220 kV bays in 400/220 kV Kalwa S/s as well as 220/100 kV Switchyard and the fire in 220/100 kV Kalwa caused DC mixing in 220 kV yard.

Table 1 : Event chronology based on DR and PMU data

| Time from MSETCL | Duration w.r.t MSETCL | Timing based on Kalwa PMU | Event |
|------------------|-----------------------|---------------------------|--|
| 02:27.01.023 | 0 msec | 02:21:48.800 | Initiation of Transformer L3 fault |
| 02:27.01.023 | 0 msec | | Differential IDIFF>> (Without delay) ON |
| 02:27.01.044 | 21 msec | | Differential IDIFF> (Without delay) ON |
| 02:27.01.052 | 29 msec | | Buchhloz Relay trip |
| 02:27.01.065 | 42 msec | | PRV Trip ON |
| 02:27.01.082 | 59 msec | | Differential relay off-fault cleared by Protection (TF HV CB Trip) |
| 02:27.01.113 | 90 msec | 02:21:48.920 | OSR Trip |
| 02:27.03.224 | 2201 msec | 02:21:51:000 | R-Ph Wave trap fault on 220kv Kalwa-AKP line at 220kv Kalwa due to transformer fire (Distance Protection) |
| 02:27.03.283 | 2260 msec | | 220kv AKP CB at 220kv Kalwa CB R-pole power contact separated (DPR reset) |
| 02:27.03.293 | 2270 msec | | R-ph CB pole re-strike due to non-quenching of arc |
| 02:27.03.293 | 2270 msec | | Distance Protection PU again (BFR Start) |
| 02:27.03.493 | 2470 msec | | 220kv AKP Line-BFR operated |
| 02:27.03.531 | 2508 msec | | BB zone-2 tripping initiated through LBB Protection |
| 02:27.03.616 | 2593 msec | | All bays connected to BB zone-2 tripped |
| No Timing | | 02:28:24.200 | LTS operation |
| No Timing | - | 02:29:28.200 | Due to heavy fire caught by Tf-01, the suspension string from dummy tower melt down and fell on 100kV creek side bus |

Restoration Details: The details of Restoration is given in the Attached MSETCL report. It was intimated that the complete sub-station repair due to the above damage was done on war footing basis within 15 days.

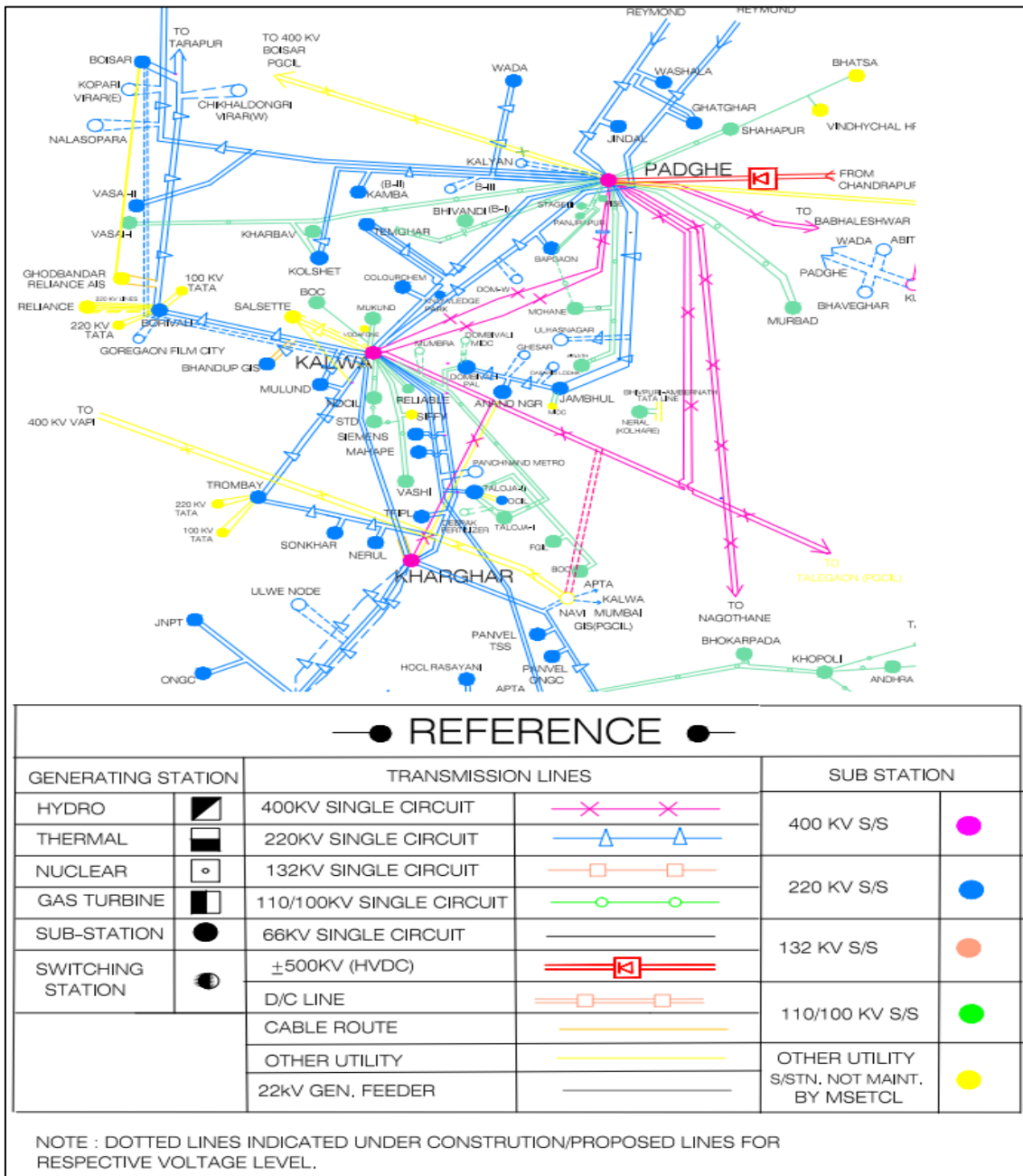


Figure 4 : Geographical Map

Issues Observed:

1. The high fault level in the Kalwa and Padghe is of great concern. It can be seen that on various occasion of fault, the fault current has exceeded the equipment rating. In this cases the high fault current has resulted in the restriking in the circuit breaker causing further tripping in the system.
2. The event is of high significant based on the damage that it has caused. However the impact was less due to its occurrence during the off peak hour. The same could have widespread in the case that the event would have occurred during off-peak hour.
3. Lack of fire protection and water sprinkler system along with the oil sump in case of 220 kV transformer.
4. The protection operation of 220 kV Kalwa-AKP circuit at AKP end need to be checked.



MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO. LTD.

| | |
|--|---|
| From, Office of the Superintending Engineer, Testing & Communication Circle, 4 th Floor, MSEB Adm. Bldg., Sector-17, Vashi, Navi Mumbai-400703. Tel: (022) 27656040 / 27656039 Fax: 27653463 E-Mail: se7500@mahatransco.in, CIN No.U40109MH2005SGC153646 Website: www.mahatransco.in | To, The Chief Engineer, EHV CC O&M Zone, M. S. E. T. Co. Ltd., Vashi. |
|--|---|

Ref: SE/TCC/VSH/Tech/No. 105

Date: 12.03.2016

Sub: - Tripping of 220/22kV 50 MVA TF no 1 Make CGL (Sr. No. T8974/1) at 220kV Kalwa sub-Station on 11.03.2016 @ 02:25 Hrs. Failure report thereof.

On dtd 11.03.2016 @02:25 Hrs, 220/22kV 50 MVA TF no-1 Make CGL (Sr. no. T8974/1) at 220kV Kalwa substation caught fire & tripped on following indications. Simultaneously the 220kV LBB protection of 220kV AKP feeder operated, resulted into tripping of all 220kV feeders connected to 220kV bus zone 2 (Creek side). Also the 100kV bus bar zone 2 protections operated due to melting & resting of dummy tower conductor on 100kV bus, resulted into tripping of all feeders connected to 100kV bus zone 2 (Creek side).

The details failure & occurrence report is as under.

| Sr. No. | Name of Line/TF/ITC | Local end | | Remote end | | Load (MW) |
|---------|-------------------------|--|--|------------|-------|-----------|
| | | W. I. | R. I. | W. I. | R. I. | |
| 1 | 220/22kV 50 MVA TF no 1 | 1. Differential protection operated 2. Main/OLTC Buchholz trip 3. Main Buchholz alarm 4. OIL/Winding Temp. high trip 5. PRV trip 6. Oil/winding temp high alarm 7. Oil level low alarm | Differential Relay (7UT61-87) -Differential PU RYB phase - Differential High set trip -3 phase trip relay K86 -DC Supervision relay K80B1/B2/C1 K80C2/D1/D2 K80E1/E2/F1 IL1=62.2A, IL2=58.2A, IL3= 47.8KA 2. Aux Relay: 30A -Buchholz Trip 30B -OTI Trip 30C -OLTC Buch. Trip 30D -PRV Trip 30E -WTI Trip 30G - Buch. Alarm 30H -WTI Alarm 30J -OTI Alarm 30K - Low Oil Level Alarm | — | — | NO Load |

| | | | | | | |
|----|---------------------------------|--|--|---|--|-------|
| 2 | 220kV Bus-bar ABB REB 500 | 1. Isolator alarm 2. Trip bus bar zone-2 | Bus bar trip relay: 1. 96T : AKP 2. 96T : 50MVA TF-1 3. 96T : 200MVA ICT-1 4. 96T : 200MVA ICT-2 5. 96T : 220kV BS | — | — | |
| 3 | 220kV Bus section | 1. Bus-bar zone-2 optd. 2. LBB/BU optd. 3. Bus bar CT supervision open 4. Trip Relay optd | BU Relay (BP to BB): General trip, R OC, Master trip relay K86 | — | — | |
| 4 | 220kV Kalwa-AKP | 1. Dist. Optd. 2. B/U Optd 3. A/R LO 4. LBB Optd 5. Trip Ckt sup. 6. Problem in CB | Dist. Prot. Relay 7SA522: General trip, R-E, Zone 1 B/U Relay 7SJ62: General trip, R-OC, EF | — | Dist. Prot. Relay REL670: General trip, R-E, Zone-2 trip, 86RX, 86YX, 86BX | 25MW |
| 5 | 200MVA, 220/100kV ICT-1 | DC fail | HV B/U: OC: R- PU/B-PU Master trip Relay 86 | — | — | 75MW |
| | | CTR Indication: | 1. Drain valve open 2. Extinction in progress 3. PRV trip 4. Buchhloz trip 5. Master trip 6. Fire detector trip 7. TF trip | — | — | |
| 6 | 200MVA, 220/100kV ICT-2 | DC fail | HV B/U: OC: R- PU/B-PU Master trip Relay 86 | — | — | 67MW |
| 7 | 100kV Bus-bar ABB REB 500 | 1. Isolator alarm 2. Trip bus bar zone-2 3. Bus bar trip Y ph 4. Bus bar trip B ph | Bus bar trip relay: 1. 96T : Mukund 2 2. 96T : Mumbra 3. 96T : Salette-1 4. 96T : NOCIL-2 5. 96T : 100kV BS | — | — | |
| 8 | 100kV Bus-section | Bus bar prot. Optd. | Master trip Relay 86 | — | — | |
| 9 | 100kV Kalwa-Kalyan | Trip relay optd. | Master trip Relay 86 | — | — | 58MW |
| 10 | 100kV Kalwa-Mukund-2 | Trip relay optd. AR LO | Master trip Relay 86 | — | — | 0.1MW |
| 11 | 100kV Kalwa-Mumbra | Trip relay optd. AR LO | Master trip Relay 86 | — | — | 0.1MW |
| 12 | 100kV Kalwa-Salsette-1 | Trip relay optd. AR LO | Master trip Relay 86 | — | — | 35MW |
| 13 | 100kV Kalwa-NOCIL-2 | Trip relay optd. AR LO | Master trip Relay 86 | — | — | 23MW |
| 14 | 100kV Kalwa-Vashi 1 | Trip relay optd. AR LO | Master trip Relay 86 | — | — | 27MW |
| 15 | 100kV Kalwa-SIFY | Trip relay optd. AR LO | Master trip Relay 86 | — | — | 27MW |
| 16 | 100kV Kalwa-NOCIL-1 | Trip relay optd. AR LO | Master trip Relay 86 | — | — | 23MW |

| | | | | | | |
|----|------------------------------|--|--|----------|---------------------|-------|
| 17 | 500MVA 400/220kV ICT-1 | — | Master trip Relay 86AX, 86A, 52B, 52CD, 52EF | — | — | 248MW |
| 18 | 220kV Interconnector | Creek zone bus bar differential optd. | BUS bar to Back up Relay: OC, 86 optd. | — | — | 250MW |
| 19 | 220kV Kalwa- Apta | — | — | BU optd. | BU_OC – R, B | |

The Physical inspection of switchyard is carried out & damages observed are as under:

1. 50MVA, 220/22kV CGL TF-1 caught fire & burst. The TF body B-phase side found deformed. The TF found derailed from rail track & tilted.
2. 220kV & 22kV 3nos. each bushing found burst.
3. 220kV & 22kV 3nos. each Lightning arrester found burst.
4. 2 nos. 3 phase 22kV Power cables found damaged & partially burnt.
5. R-phase wave trap of adjacent 220kV AKP bay burnt & uncoiled.
6. R-phase LA of adjacent 220kV AKP bay burnt.
7. R-phase CB pole of adjacent 220kV AKP bay burst.
8. R-phase Line Isolator support insulator of adjacent 220kV AKP bay damaged.
9. Control cables of 220kV AKP, 200MVA ICT-1, 50MVA TF-1 & 500MVA ICT-LV bays found burnt.
10. The conductor between 220kV dummy tower terminating on 220kV gentry melted & broken.
11. 200MVA, 220/100kV ICT-1 CTR operated.

Analysis: (Pl. ref. SLD / DR)

FAULT 1: (Failure & caught fire of transformer)

- o The 50MVA, 220/22kV CGL Make TF-1 (Sr. No. T-8974/1) repaired by M/s AVAL tripped on differential relay 87_R, Y, B PU & HS, Buchhloz/PRV trip operation & caught fire.
- o The said TF was initially commissioned at 220kV Mulund s/s on dtd. 29.09.2004 (YOM_2004) & in service till 07.09.2015. The TF was taken out /removed from service on dtd. 07.09.2015 for replacement of said TF by 100MVA TF for capacity augmentation at Mulund s/s.
- o The said TF was sent to M/s AVAL for overhauling/repair & subsequently factory inspection was carried out in the month of Sept,-2015.
- o Finally the factory testing at M/s AVAL was carried out on dtd. 28.12.2015.
- o Further on 01.03.2015, the 50MVA 220/22kV TF-1 CGL make (Sr. no. Sr. No. 24596) failed at 220kV Kalwa s/s & it is decided to shift the above TF to Kalwa s/s for replacement of this failed TF.
- o After completion of erection work, the precommissioning test is carried out on 09.03.2016 & 10.03.2016. All the test results are found normal. The test results & DGA after oil filtration is enclosed herewith.
- o The said TF is charged from HV side on 10.03.2016 at 21.07hrs after taking & confirming through fault stability test & was kept on **NO Load**.
- o On 11.03.2016 at 02.20hrs, the said TF tripped on differential relay 87_R, Y, B PU & HS, Buchhloz/PRV trip operation & caught fire.

- o The fault current recorded by differential relay of TF-I is as below. The DR is enclosed.

| | | | |
|-----------------------|----------------|----------------|--------------|
| HV side: | Ia= 0.062kA | Ib= 0.058kA | Ic=47.8kA |
| LV side: | Ia= 0.000kA | Ib= 0.000kA | Ic=0.000kA |
| Differential Current: | Ia= 13.39 I/In | Ib= 13.39 I/In | Ic=26.78I/In |

The list of Events recorded by differential relay is as under-

| | |
|----------------------------|---|
| 11/03/2016, 02:25:16.701-> | Transformer Differential Pick-up IDIFF >> L1 (without delay) ON IDIFF >> L2 (without delay) ON IDIFF >> L3 (without delay) ON Trip by IDIFF >> ON |
| 02:25:16.722-> | IDIFF > L1 (without delay) ON IDIFF > L2 (without delay) ON IDIFF > L3 (without delay) ON Trip by IDIFF > ON |
| 02:25:16.781-> | IDIFF >> L1 (without delay) OFF IDIFF >> L2 (without delay) OFF IDIFF >> L3 (without delay) OFF IDIFF > L1 (without delay) OFF IDIFF > L2 (without delay) OFF IDIFF > L3 (without delay) OFF |

The fault cleared time is 80msec.

- o As seen from the operation of differential_HS, Buchhloz/PRV & the fault current recorded by differential relay and the extent of fire & damaged/deformation observed, it seems that heavy pressure is developed at the lower side of the transformer due to high discharged of energy/heavy arcing inside the transformer, indicating the fault inside the transformer. However this could not be confirmed physically due to complete damage of transformer due to fire inside the transformer.
- o The damages/shattering of all bushing (220kV & 22kV) of transformer indicates that the high pressure developed inside the transformer is released through the bushing.
- o The operation indication of OLTC buchhloz trip/Winding temp Alarm /Trip, Oil temp Alarm /Trip, Buchhloz Alarm and Low Oil level Alarm have appeared on post occurrence due to damage of cables, oil drain and fire extinguish process.
- o From the event log, it is seen that the High set differential/buchhloz trip & PRV trip operated within 45msec indicating development of high pressure due to heavy arcing fault inside the tank on HV B-ph side which might have causes the striking of fire inside the transformer & released of high pressure through B-ph HV bushing being the weak point. This resulted into immediate damage of bushing & turret CT used for REF protection which causes the non-operation of REF protection which is electromechanical Alstom make High impedance CAG type relay. The REF relay is tested & found to be operating between 60 to 90msec.
- o The cause of failure of transformer which is due to internal problem is to be discussed in detailed with manufacturer/repairer, working agency at site and MSETCL authority to find out the reason to avoid such type of failure in future as it has incurred heavy loss to MSETCL.

FAULT__2 (Operation of LBB & failure of CB R-pole in r/o 220kV AKP)

- Due to fumes, flame & fire of transformer, the adjacent 220kV AKP bay R-phase wave trap burnt & uncoiled, creating R-E fault in the system.
- At 220kV Kalwa s/s, from the relay indication & DR it is observed that the distance protection relay has sensed this fault in R-E, zone1 & initiated trip command instantaneously. All R, Y, B pole of CB opened within 24msec, but R-pole re-strike again after 10msec, this has resulted into operation of LBB protection of 220kV AKP line. The LBB trip command is extended to BB zone 2 after 200msec (LBB timer set to 200msec) & resulted into tripping of all 220kV bays connected to 220kV Bus-section 2 (Creek side). The fault is cleared by 285msec.
- The said CB is of CGL make (Sr. no. 5545C / YOM 1993) commissioned on 30.04.1996 at 220kV Kalwa s/s. The mechanism overhauling of said CB is carried out in 2008. The previous diagnostic test is carried out 05.06.2014 & results are found normal. The Test result enclosed.
- This re-striking phenomena is occurred as arc is not extinguished by the R-pole due high fault current equivalent to bus fault current of magnitude 49.06kA exceeding short time current rating (40kA) of CB.
- At AKP s/s, the wave trap faults is sensed by distance protections relay in R, Y-E, Zone-2 trip & isolate the fault. As seen in DR, it is observed that the distance protection has sensed the R-ph wave trap fault & subsequently after 297msec it has sensed the Y-phase fault due to swing & resting of R-phase wave trap jumper on Y-phase, creating R, Y, E fault & isolate in 450msec.
- At 220kV Apta s/s, the 220kV Kalwa CB tripped on BU-R & B protection with 375msec. The ROT of said line needs to be revised at 220kV Apta end.

FAULT__3 (Operation of 100kV BB)

- Due to fumes, flame & fire of transformer, the conductor between 220kV dummy tower outside switchyard terminating on 220kV gentry melted & broken and resting on 100kV bus Y & B Phase. This has created 100kV bus fault.
- All the 100kV feeders connected to creek side tripped on operation of bus bar protection at 220kV Kalwa s/s.
- Due to burning of control cables in trenches, DC grounding /mixing, the LTS trip relay of 400kV ICT load trimming scheme at 220kV Kalwa s/s operated. This has affected the power supply at 220kV Colourchem s/s (80MW), 100kV Vashi s/s (54MW), 100kV NOCIL s/s (46MW) and 22kV feeder (27MW) at Kalwa.
- The CTR make fire protection system of 200MVA, 220/100kV ICT-1 is also operated due to DC mixing i.e. burning of control cables in switchyard due to transformer fire.
- The 500MVA, 400/220kV ICT-1 tripped at 400kV s/s due to DC mixing i.e. burning of control cables in switchyard due to transformer fire.

Restoration:

| Sr. No. | Name of Line/TF/ICT | Date & time of tripping | Date & time of Restoration | Duration | Remarks |
|---------|-------------------------|-------------------------|----------------------------|----------|-----------|
| 1 | 220KV Kalwa- AKP | 11.03.2016 02.20hrs | 11.03.2016 22.57hrs | 22.37hrs | |
| 2 | 200MVA, 220/100kV ICT-1 | | — | — | Still out |
| 3 | 200MVA, 220/100kV ICT-2 | | 11.03.2016 23.04hrs | 20.44hrs | |
| 4 | 220kV Bus- section | | 11.03.2016 22.22hrs | 20.02hrs | |
| 5 | 220kV Interconnector | | — | — | Still out |
| 6 | 220kV Kalwa-Apta | | 11.03.2016 03.10hrs | 00.50hrs | |
| 7 | 100kV Kalwa-NOCIL-2 | 11.03.2016 02.30hrs | — | — | Still out |
| 8 | 100kV Kalwa-salsette-1 | | — | — | Still out |
| 9 | 100kV Kalwa-Kalyan | | 11.03.2016 03.32hrs | 1.02 | |
| 10 | 100kV Kalwa-Mukund-2 | | — | — | Still out |
| 11 | 100kV Kalwa-Mumbra | | — | — | Still out |
| 12 | 100kV bus-section | | 11.03.2016 22.33hrs | 20.03hrs | |
| 13 | 100kV Kalwa- NOCIL-1 | 11.03.2016 02.46hrs | 11.03.2016 03.20hrs | 00.34hrs | |
| 14 | 100kV Kalwa-Vashi-1 | | 11.03.2016 03.21hrs | 00.35hrs | |
| 15 | 100kV Kalwa-SIFY | | 11.03.2016 03.24hrs | 00.38hrs | |

Suggestions:

- The failure of transformer is being referred to manufacturer / repairer for detailed cause of failure.
- The Fire protection system may be provided for 220kV voltage class transformer irrespective of MVA capacity at all critical sub-station.
- Alternatively water sprinkler system may be provided which will be helpful in controlling the temperature as well as arresting the fire till fire tender reaches the site (As a back up to fire protection system).
- Oil sump shall be provided for all existing & augmented /replaced transformers irrespective of voltage level & transformer capacity, which will be helpful to avoid the spreading of oil in switchyard in case of fire & subsequently burning of switchyard cables.
- Fire Retarding coating on cables be provided so that cables can be saved. FRLS cables will be a better solution.
- Fire protection wall shall be provided invariably in between the adjacent transformer to prevent transformer from damaged.
- To avoid damaged of control cable due to fire of transformer, cable trenches in the switchyard should be sufficiently away from transformer & control cable between transformer & control room should be avoided by using modern state of art technology numerical/digital scheme using OPGW. This is being discussed in SPC.

- The guidelines for transformer manufacturing process & site commissioning activity by qualified experience agency are to be reviewed for prompt implementation without deviation. This is being discussed in SPC.
- The fault MVA of 220kV Kalwa bus is exceeding the short time current of equipments. The immediate action to reduce it is to be taken on priority. The provision of FCL is under consideration. This is to be discussed in SPC.

Submitted please.

Encl.: - A/a



Superintending Engineer,
Testing & Communication Circle, **Vashi.**

Copy s.w. rs. to:

The Chief Engineer (TR O&M) CO, Mumbai.
The Chief Engineer, SLDC, Kalwa.

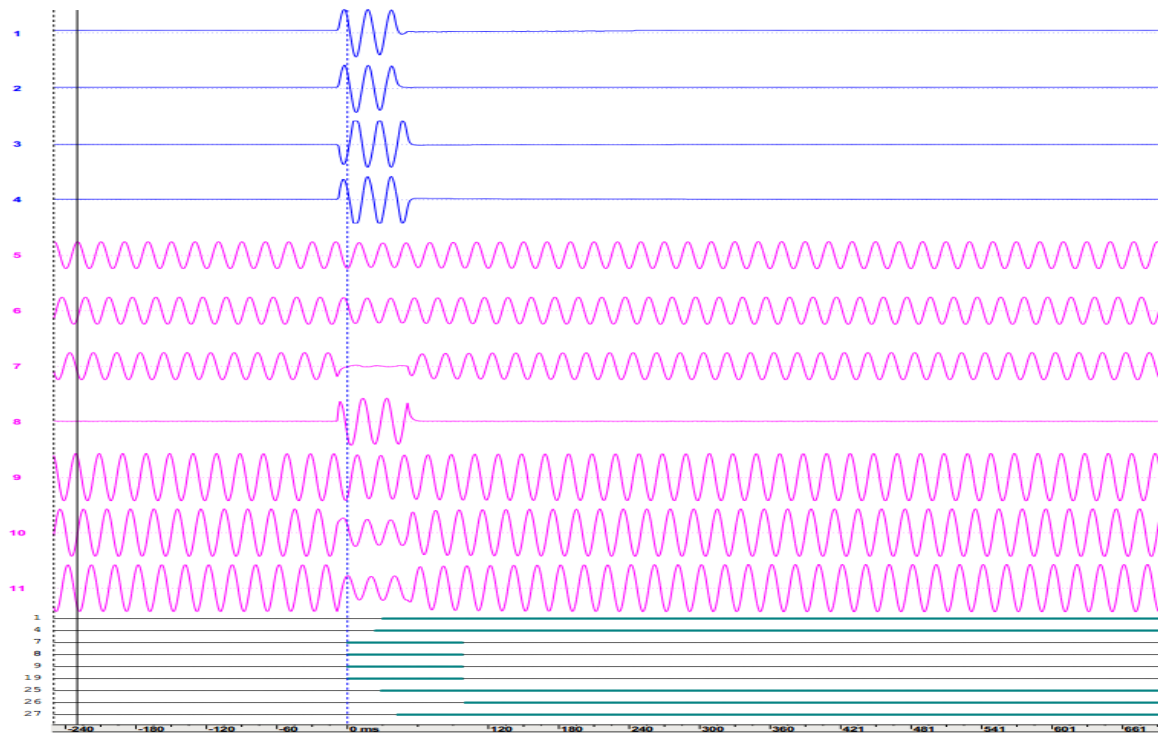
Copy f.w.cs. to:

The Superintending Engineer, EHV O&M Circle, Kalwa.

Copy to:

The Executive Engineer, 400kV RS O&M Dn., Kalwa.
The Executive Engineer, EHV Testing Dn., Kalwa.

1. DR of 220/22 kV ICT Transformer Backup Protection



```

11 >Trig.Wave.Cap. 4 N A 02:23:37.779672 001
41 >BrkFail extSRC 1431 N A 02:23:37.773408 001
71 O/C Ph L3 PU 1764 N N 02:23:37.749600 02:23:37.848587 002
81 O/C Earth PU 1765 N N 02:23:37.749600 02:23:37.848587 002
91 Overcurrent PU 1761 N N 02:23:37.749600 02:23:37.848587 002
191 Relay PICKUP 501 N N 02:23:37.749600 02:23:37.848587 002
251 Main Buchh 65528 N A 02:23:37.778419 001
261 OLTC Buchh 65527 N A 02:23:37.849841 001
271 PRV Trip 65526 N A 02:23:37.792202 001
    
```

* File Information:*

```

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Device: 001545
File Name: D:\MDF\A2 TCC\19 TF FAILURE REPROT_ VASHI\2015-16\220KV KALWA 11.03.2016\DR 220KV KALWA\50 MVA TF_
File Size: 81107 Bytes
Prefault Time: 11/03/2016 02:23:37.499000
Fault Time: 11/03/2016 02:23:37.749600
Save Time: 03/12/2016 15:54:14
Process Time: 03/14/2016 11:02:50
Start Date & Time: 11/03/2016 02:23:37.499000
End Date & Time: 11/03/2016 02:23:38.445015
File Duration: 946 Mills(s) - 15 Mics(s)
Sampling Frequency: 798.084597, 1253.000 Microsecond Rate
Line Frequency: 50.000000
    
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* Maximum/Minimum Analog Summary:*

| > | Max-Inst | Min-Inst | Max-RMS | Min-RMS | One-Bit | Inst-Diff | RMS-Diff | pUnits | Description |
|---|----------|----------|---------|---------|---------|-----------|----------|--------|-------------|
| | 0.108 | -0.136 | 0.087 | 0.000 | 0.0025 | 0.028 | 0.087 | A | 1-iL1 1 |
| | 0.103 | -0.116 | 0.078 | 0.000 | 0.0025 | 0.013 | 0.078 | A | 2-iL2 2 |
| | 82.331 | -79.525 | 61.482 | 0.000 | 0.0025 | 2.806 | 61.482 | A | 3-iL3 3 |
| | 79.676 | -82.379 | 61.441 | 0.000 | 0.0025 | 2.703 | 61.441 | A | 4-iE 4 |
| | 95.424 | -95.290 | 94.213 | 61.279 | 0.1346 | 0.135 | 32.934 | V | 5-uL1 5 |
| | 96.366 | -96.636 | 68.439 | 36.790 | 0.1346 | 0.269 | 31.649 | V | 6-uL2 6 |
| | 95.559 | -95.559 | 78.104 | 2.463 | 0.1346 | 0.000 | 75.641 | V | 7-uL3 7 |
| | 80.619 | -83.580 | 60.205 | 0.200 | 0.1346 | 2.961 | 60.005 | V | 8-uEn 8 |
| | 166.488 | -166.219 | 151.818 | 94.330 | 0.1346 | 0.269 | 57.488 | V | 9-uL12 105 |
| | 166.757 | -166.892 | 121.490 | 21.265 | 0.1346 | 0.135 | 100.225 | V | 10-uL23 106 |
| | 166.488 | -166.622 | 151.806 | 59.399 | 0.1346 | 0.135 | 92.406 | V | 11-uL31 107 |

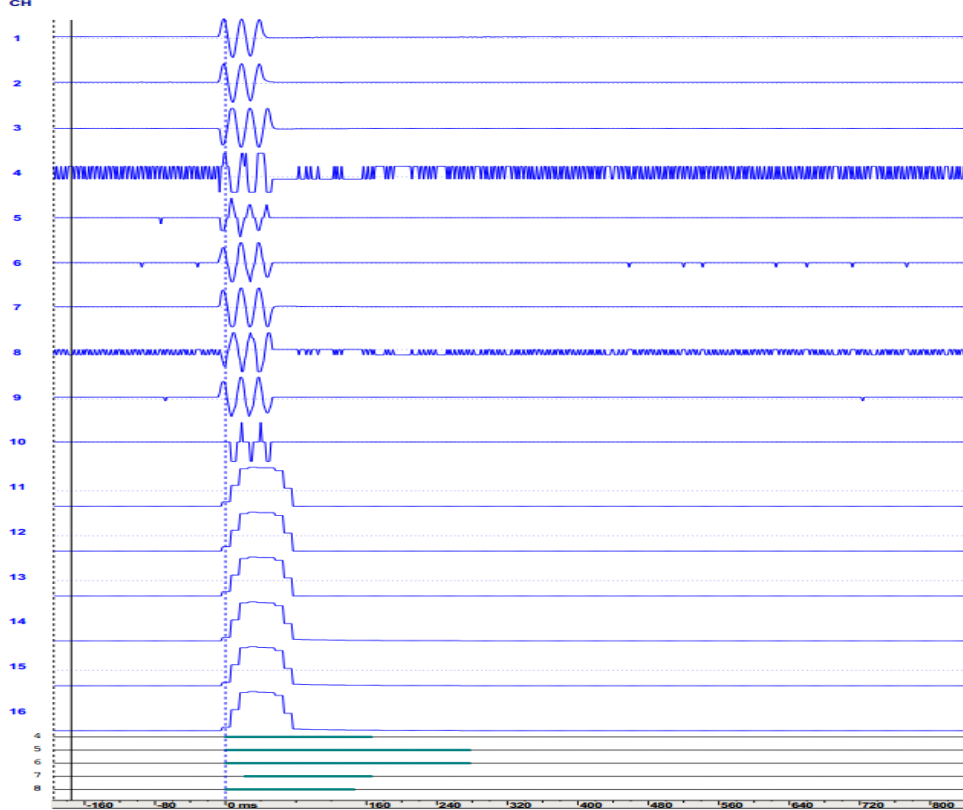
* Events/Sensors Activity Summary:*

| > | Fst | Lst | Fst-Change | Lst-Change | Changes | Description |
|---|-----|-----|-----------------|-----------------|---------|------------------------|
| N | N | N | 02:23:37.779672 | xx:xx:xx.xxxxxx | 001 | 1->Trig.Wave.Cap. 4 |
| N | N | N | 02:23:37.773408 | xx:xx:xx.xxxxxx | 001 | 4->BrkFail extSRC 1431 |
| N | N | N | 02:23:37.749600 | 02:23:37.848587 | 002 | 7-O/C Ph L3 PU 1764 |
| N | N | N | 02:23:37.749600 | 02:23:37.848587 | 002 | 8-O/C Earth PU 1765 |
| N | N | N | 02:23:37.749600 | 02:23:37.848587 | 002 | 9-Overcurrent PU 1761 |
| N | N | N | 02:23:37.749600 | 02:23:37.848587 | 002 | 19-Relay PICKUP 501 |
| N | N | N | 02:23:37.778419 | xx:xx:xx.xxxxxx | 001 | 25-Main Buchh 65528 |
| N | N | N | 02:23:37.849841 | xx:xx:xx.xxxxxx | 001 | 26-OLTC Buchh 65527 |
| N | N | N | 02:23:37.792202 | xx:xx:xx.xxxxxx | 001 | 27-PRV Trip 65526 |

2. DR of 220/22 kV ICT Transformer Differential Protection

50MVA TF_01_DIFF.dat - 11/03/2016 - 02:25:16.701 - Secondary - (Peak Type)

Page: 1



```

4I Relay TRIP 511      N N 02:25:16.701039 02:25:16.867739 002
5I Relay PICKUP 501   N N 02:25:16.701039 02:25:16.979428 002
6I Diff picked up 5631 N N 02:25:16.701039 02:25:16.979428 002
7I Diff> TRIP 5691    N N 02:25:16.722710 02:25:16.867739 002
8I Diff>> TRIP 5692   N N 02:25:16.701039 02:25:16.847735 002
    
```

* File Information:

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      Device: 002063
      File Name: D:\NDP\2 TCC\19 TF FAILURE REPROT_ VASHI\2015-16\220KV KALWA 11.03.2016\DR 220KV KALWA\50MVA TF_0
      File Size: 42498 Bytes
      Prefault Time: 11/03/2016 02:25:16.506000
      Fault Time: 11/03/2016 02:25:16.701039
      Save Time: 03/12/2016 15:51:20
      Process Time: 03/14/2016 11:03:56
      Start Date && Time: 11/03/2016 02:25:16.506000
      End Date && Time: 11/03/2016 02:25:17.544541
      File Duration: 1 Sec(s) - 38 Mills(s) - 541 Mics(s)
      Sampling Frequency: 599.880024, 1667.000 Microsecond Rate
      Line Frequency: 50.000000
    
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* Maximum/Minimum Analog Summary:

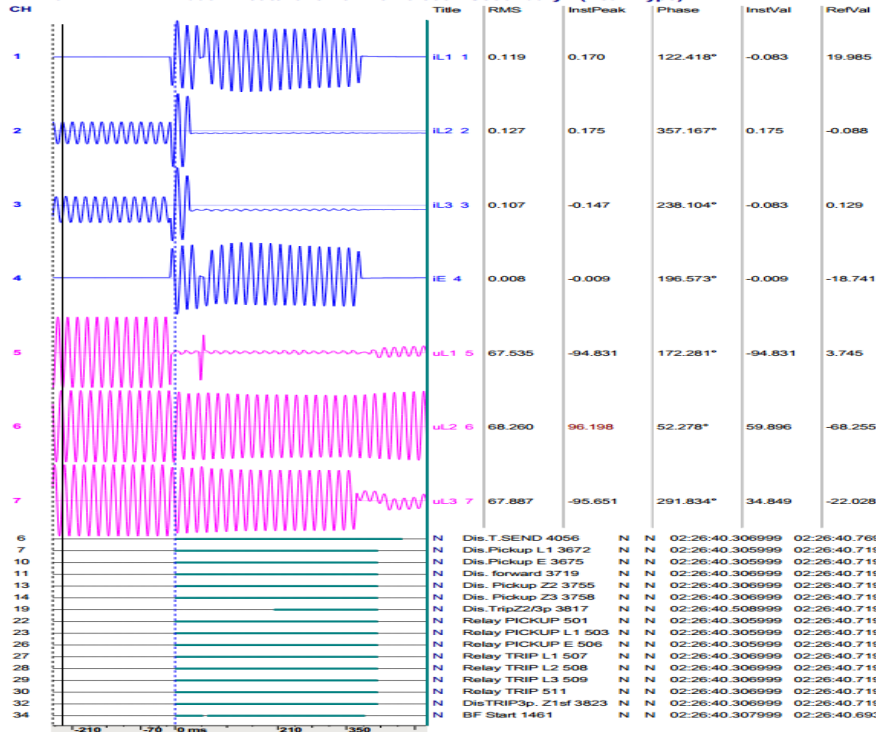
| > | Max-Inst | Min-Inst | Max-RMS | Min-RMS | One-Bit | Inst-Diff | RMS-Diff | pUnits | Description |
|---|----------|----------|---------|---------|---------|-----------|----------|--------|-----------------|
| | 0.110 | -0.110 | 0.078 | 0.002 | 0.0025 | 0.000 | 0.075 | A | 1-iL1-S1 1 |
| | 0.105 | -0.103 | 0.073 | 0.005 | 0.0025 | 0.002 | 0.068 | A | 2-iL2-S1 2 |
| | 81.470 | -76.855 | 60.428 | 0.000 | 0.0025 | 4.615 | 60.428 | A | 3-iL3-S1 3 |
| | 0.008 | 0.000 | 0.005 | 0.002 | 0.0025 | 0.008 | 0.003 | A | 4-iL1-S2 1 |
| | 0.008 | -0.008 | 0.004 | 0.000 | 0.0025 | 0.000 | 0.004 | A | 5-iL2-S2 2 |
| | 0.013 | -0.008 | 0.008 | 0.002 | 0.0025 | 0.005 | 0.005 | A | 6-iL3-S2 3 |
| | 76.648 | -81.483 | 60.280 | 0.011 | 0.0025 | 4.835 | 60.269 | A | 7-3i0-S1 172 |
| | 0.003 | -0.015 | 0.009 | 0.004 | 0.0025 | 0.013 | 0.005 | A | 8-3i0-S2 173 |
| | 0.018 | -0.008 | 0.010 | 0.004 | 0.0025 | 0.010 | 0.006 | A | 9-i7 180 |
| | 0.000 | -0.000 | 0.000 | 0.000 | 0.0001 | 0.000 | 0.000 | A | 10-i8 181 |
| | 118.740 | 0.000 | 117.814 | 0.000 | 0.0200 | 118.740 | 117.814 | I/InO | 11-IDiff-L1 182 |
| | 118.720 | 0.000 | 117.784 | 0.000 | 0.0200 | 118.720 | 117.784 | I/InO | 12-IDiff-L2 183 |
| | 237.480 | 0.000 | 235.607 | 0.000 | 0.0200 | 237.480 | 235.607 | I/InO | 13-IDiff-L3 184 |
| | 119.460 | 0.020 | 118.167 | 0.020 | 0.0200 | 119.440 | 118.147 | I/InO | 14-IRest-L1 185 |
| | 119.440 | 0.000 | 118.147 | 0.000 | 0.0200 | 119.440 | 118.147 | I/InO | 15-IRest-L2 186 |
| | 238.900 | 0.020 | 236.314 | 0.020 | 0.0200 | 238.880 | 236.294 | I/InO | 16-IRest-L3 187 |

* Events/Sensors Activity Summary:

```

* -----
>Fst Lst Fst-Change Lst-Change Changes Description
N N 02:25:16.701039 02:25:16.867739 002 4-Relay TRIP 511
N N 02:25:16.701039 02:25:16.979428 002 5-Relay PICKUP 501
N N 02:25:16.701039 02:25:16.979428 002 6-Diff picked up 5631
N N 02:25:16.722710 02:25:16.867739 002 7-Diff> TRIP 5691
N N 02:25:16.701039 02:25:16.847735 002 8-Diff>> TRIP 5692
    
```

3. DR of 220 kV Kalwa-AKP line from Kalwa end indicating restriking in R phase.



220KV KALWA 220KV AKP LINE 7SA522 V4.6 Var DT: 11/03/2016 02:26:40.075999 Dt: 230000 microsec - 11.50 Cvc 1000.0000 /

* File Information:*

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Device: 000066
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File Size: 92138 Bytes
Prefault Time: 11/03/2016 02:26:40.055999
Fault Time: 11/03/2016 02:26:40.305999
Save Time: 03/12/2016 15:15:06
Process Time: 03/14/2016 11:27:23
Start Date && Time: 11/03/2016 02:26:40.055999
End Date && Time: 11/03/2016 02:26:40.819999
File Duration: 764 Mils(s)
Sampling Frequency: 1000.000000, 1000.000 Microsecond Rate
Line Frequency: 50.000000
    
```

* Maximum/Minimum Analog Summary:

| > | Max-Inst | Min-Inst | Max-RMS | Min-RMS | One-Bit | Inst-Diff | RMS-Diff | pUnits | Description |
|---|----------|----------|---------|---------|---------|-----------|----------|--------|-------------|
| | 97.869 | -93.722 | 63.324 | 0.088 | 0.0046 | 4.147 | 63.237 | A | 1-iL1 1 |
| | 0.627 | -0.544 | 0.425 | 0.004 | 0.0046 | 0.083 | 0.422 | A | 2-iL2 2 |
| | 0.479 | -0.359 | 0.300 | 0.000 | 0.0046 | 0.120 | 0.300 | A | 3-iL3 3 |
| | 93.814 | -98.597 | 63.901 | 0.004 | 0.0046 | 4.783 | 63.897 | A | 4-iE 4 |
| | 95.142 | -95.123 | 94.934 | 1.777 | 0.0094 | 0.019 | 93.157 | V | 5-uL1 5 |
| | 96.198 | -96.765 | 69.455 | 36.327 | 0.0094 | 0.566 | 33.128 | V | 6-uL2 6 |
| | 96.048 | -96.000 | 79.060 | 9.949 | 0.0094 | 0.047 | 69.111 | V | 7-uL3 7 |

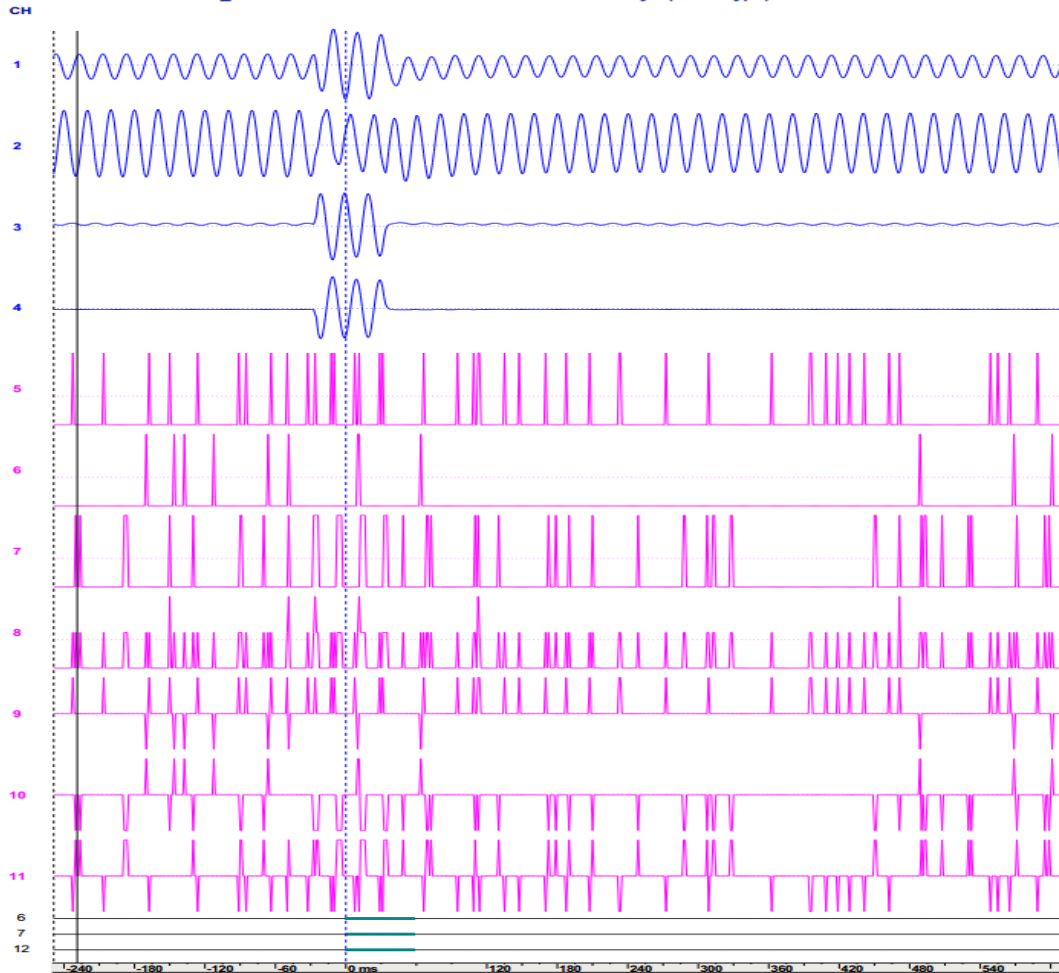
* Events/Sensors Activity Summary:

| > | Fst | Lst | Fst-Change | Lst-Change | Changes | Description |
|---|-----|-----|-----------------|-----------------|---------|-------------------------|
| N | N | | 02:26:40.306999 | 02:26:40.769999 | 002 | 6-Dis.T.SEND 4056 |
| N | N | | 02:26:40.305999 | 02:26:40.719999 | 002 | 7-Dis.Pickup L1 3672 |
| N | N | | 02:26:40.305999 | 02:26:40.719999 | 002 | 10-Dis.Pickup E 3675 |
| N | N | | 02:26:40.306999 | 02:26:40.719999 | 002 | 11-Dis. forward 3719 |
| N | N | | 02:26:40.306999 | 02:26:40.719999 | 002 | 13-Dis. Pickup 22 3755 |
| N | N | | 02:26:40.306999 | 02:26:40.719999 | 002 | 14-Dis. Pickup 23 3758 |
| N | N | | 02:26:40.508999 | 02:26:40.719999 | 002 | 19-Dis.Trip22/3p 3817 |
| N | N | | 02:26:40.305999 | 02:26:40.719999 | 002 | 22-Relay PICKUP 501 |
| N | N | | 02:26:40.305999 | 02:26:40.719999 | 002 | 23-Relay PICKUP L1 503 |
| N | N | | 02:26:40.305999 | 02:26:40.719999 | 002 | 26-Relay PICKUP E 506 |
| N | N | | 02:26:40.306999 | 02:26:40.719999 | 002 | 27-Relay TRIP L1 507 |
| N | N | | 02:26:40.306999 | 02:26:40.719999 | 002 | 28-Relay TRIP L2 508 |
| N | N | | 02:26:40.306999 | 02:26:40.719999 | 002 | 29-Relay TRIP L3 509 |
| N | N | | 02:26:40.306999 | 02:26:40.719999 | 002 | 30-Relay TRIP 511 |
| N | N | | 02:26:40.306999 | 02:26:40.719999 | 002 | 32-DisTRIP3p. Z1sf 3823 |
| N | N | | 02:26:40.307999 | 02:26:40.693999 | 004 | 34-BF Start 1461 |

4. 220 kV Bus section 2 DR

220KV BUS SECTION_DR1.dat - 11/03/2016 - 02:27:01.022 - Secondary - (Peak Type)

Page: 1



220kV KALWA 220 B SEC KALWA 7SJ622 V4.7 Var DT: 11/03/2016 02:27:00.794016 Dt: 228933 microsec - 11.45 Cvc 799.3605
 6 N O/C Ph L3 PU 1764 N N 02:27:01.022949 02:27:01.081746 002
 7 N Overcurrent PU 1761 N N 02:27:01.022949 02:27:01.081746 002
 12 N Relay PICKUP 501 N N 02:27:01.022949 02:27:01.081746 002

* File Information: *

```

Station: 220kV KALWA 220 B SEC KALWA 7SJ622 V4.7 Var
Device: 000099
File Name: D:\NDP\2 TCC\19 TF FAILURE REPROT_ VASHI\2015-16\220KV KALWA 11.03.2016\DR 220KV KALWA\220KV BUS
File Size: 55094 Bytes
Prefault Time: 11/03/2016 02:27:00.774000
Fault Time: 11/03/2016 02:27:01.022949
Save Time: 03/12/2016 16:02:08
Process Time: 03/14/2016 11:28:28
Start Date & Time: 11/03/2016 02:27:00.774000
End Date & Time: 11/03/2016 02:27:01.634688
File Duration: 860 Mills (s) - 688 Mics (s)
Sampling Frequency: 798.722045, 1252.000 Microsecond Rate
Line Frequency: 50.000000
    
```

* Maximum/Minimum Analog Summary:

| > Max-Inst | Min-Inst | Max-RMS | Min-RMS | One-Bit | Inst-Diff | RMS-Diff | pUnits | Description |
|------------|----------|---------|---------|---------|-----------|----------|--------|-------------|
| 1.791 | -1.564 | 1.212 | 0.367 | 0.0025 | 0.227 | 0.845 | A | 1-iL1 1 |
| 0.652 | -0.728 | 0.589 | 0.339 | 0.0025 | 0.076 | 0.251 | A | 2-iL2 2 |
| 18.013 | -20.706 | 13.816 | 0.096 | 0.0025 | 2.693 | 13.720 | A | 3-iL3 3 |
| 18.923 | -16.958 | 12.717 | 0.019 | 0.0025 | 1.965 | 12.698 | A | 4-iE 4 |
| 0.135 | 0.000 | 0.067 | 0.000 | 0.1346 | 0.135 | 0.067 | V | 5-uL1 5 |
| 0.135 | 0.000 | 0.048 | 0.000 | 0.1346 | 0.135 | 0.048 | V | 6-uL2 6 |
| 0.135 | 0.000 | 0.067 | 0.000 | 0.1346 | 0.135 | 0.067 | V | 7-uL3 7 |
| 0.269 | 0.000 | 0.106 | 0.000 | 0.1346 | 0.269 | 0.106 | V | 8-uEn 8 |
| 0.135 | -0.135 | 0.067 | 0.000 | 0.1346 | 0.000 | 0.067 | V | 9-uL12 105 |
| 0.135 | -0.135 | 0.082 | 0.000 | 0.1346 | 0.000 | 0.082 | V | 10-uL23 106 |
| 0.135 | -0.135 | 0.082 | 0.000 | 0.1346 | 0.000 | 0.082 | V | 11-uL31 107 |

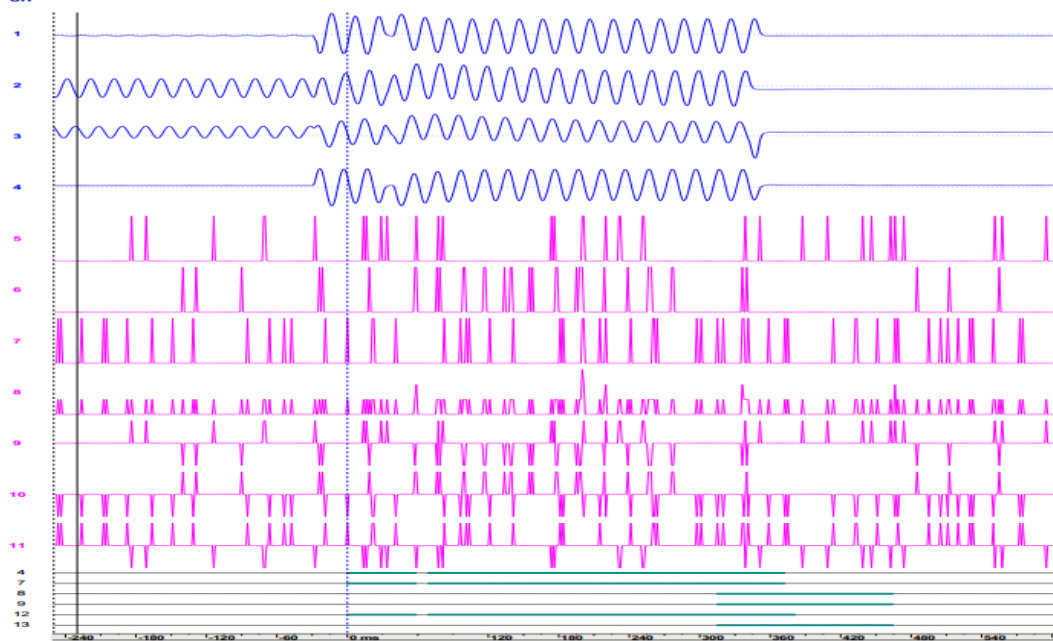
* Events/Sensors Activity Summary:

| > Fat | Lst | Fst-Change | Lst-Change | Changes | Description |
|-------|-----|-----------------|-----------------|---------|-----------------------|
| N | N | 02:27:01.022949 | 02:27:01.081746 | 002 | 6-O/C Ph L3 PU 1764 |
| N | N | 02:27:01.022949 | 02:27:01.081746 | 002 | 7-Overcurrent PU 1761 |
| N | N | 02:27:01.022949 | 02:27:01.081746 | 002 | 12-Relay PICKUP 501 |

5. DR of 220 kV Bus section 2

220KV BUS SECTION_DR2.dat - 11/03/2016 - 02:27:03.224 - Secondary - (Peak Type)

Page: 1



```

4 N O/C Ph L1 PU 1762 N N 02:27:03.224201 02:27:03.596998 004
7 N Overcurrent PU 1761 N N 02:27:03.224201 02:27:03.596998 004
8 N OvercurrentTRIP 1791 N N 02:27:03.539452 02:27:03.689572 002
9 N I>> TRIP 1805 N N 02:27:03.539452 02:27:03.689572 002
12 N Relay PICKUP 501 N N 02:27:03.224201 02:27:03.605755 004
13 N Relay TRIP 511 N N 02:27:03.539452 02:27:03.689572 002
  
```

* File Information::

```

* -----
      Station: 220kV KALWA   220 B SEC KALWA   7SJ622 V4.7 Var
      Device: 000100
      File Name: D:\NDP\2 TCC\19 TF FAILURE REPROT_ VASHI\2015-16\220KV KALWA 11.03.2016\DR 220KV KALWA\220KV BUS
      File Size: 55702 Bytes
      Prefault Time: 11/03/2016 02:27:02.974000
      Fault Time: 11/03/2016 02:27:03.224200
      Save Time: 03/12/2016 16:03:08
      Process Time: 03/14/2016 11:29:07
      Start Date && Time: 11/03/2016 02:27:02.974000
      End Date && Time: 11/03/2016 02:27:03.834688
      File Duration: 860 Mils(s) - 688 Mics(s)
      Sampling Frequency: 798.722045, 1252.000 Microsecond Rate
      Line Frequency: 50.000000
  
```

* Maximum/Minimum Analog Summary:

```

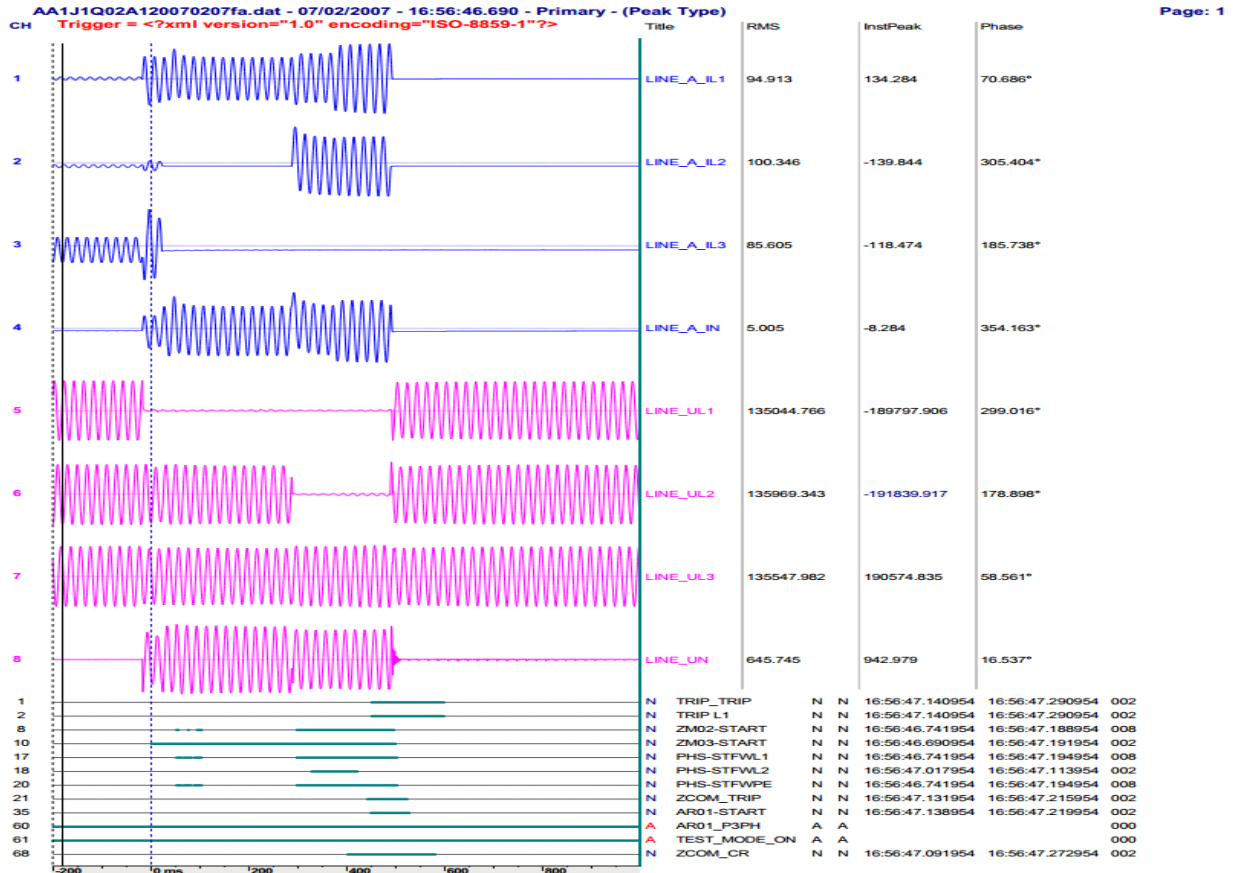
* -----
> Max-Inst   Min-Inst   Max-RMS   Min-RMS   One-Bit   Inst-Diff   RMS-Diff   pUnits   Description
    21.270    -17.651    14.002    0.076    0.0025    3.620      13.927    A        1-iL1 1
     1.456     -1.081     0.860    0.034    0.0025    0.375      0.826    A        2-iL2 2
     1.564     -2.237     1.272    0.003    0.0025    0.673      1.269    A        3-iL3 3
    15.991    -19.409    12.841    0.022    0.0025    3.418     12.818    A        4-iE 4
     0.135     0.000     0.058    0.000    0.1346    0.135      0.058    V        5-uL1 5
     0.135     0.000     0.067    0.000    0.1346    0.135      0.067    V        6-uL2 6
     0.135     0.000     0.078    0.000    0.1346    0.135      0.078    V        7-uL3 7
     0.404     0.000     0.139    0.000    0.1346    0.404      0.139    V        8-uEn 8
     0.135    -0.135     0.075    0.000    0.1346    0.000      0.075    V        9-uL12 105
     0.135    -0.135     0.082    0.000    0.1346    0.000      0.082    V       10-uL23 106
     0.135    -0.135     0.078    0.000    0.1346    0.000      0.078    V       11-uL31 107
  
```

* Events/Sensors Activity Summary:

```

* -----
>Fst  Lst  Fst-Change  Lst-Change  Changes  Description
  N   N   02:27:03.224201 02:27:03.596998 004    4-O/C Ph L1 PU 1762
  N   N   02:27:03.224201 02:27:03.596998 004    7-Overcurrent PU 1761
  N   N   02:27:03.539452 02:27:03.689572 002    8-OvercurrentTRIP 1791
  N   N   02:27:03.539452 02:27:03.689572 002    9-I>> TRIP 1805
  N   N   02:27:03.224201 02:27:03.605755 004    12-Relay PICKUP 501
  N   N   02:27:03.539452 02:27:03.689572 002    13-Relay TRIP 511
  
```

6. DR of 220 kV Kalwa-AKP line from AKP end indicating restriking in R phase. Initially fault of R phase was seen in Zone 2/3 however zone 2 got reset and later fault appeared in Y phase also and again Zone 2 started and tripped the circuit.



* File Information: *

```

Station: AIROLI KNOW PARK
Device: 1
File Name: D:\NDP\2 TCC\19 TF FAILURE REPROT_ VASHI\2015-16\220KV KALWA 11.03.2016\DR AKP\220KV AKP-KALWA LI
File Size: 40834 Bytes
Prefault Time: 07/02/2007 16:56:46.489954
Fault Time: 07/02/2007 16:56:46.690657
Save Time: 03/11/2016 11:29:14
Process Time: 03/14/2016 11:29:51
Start Date & Time: 07/02/2007 16:56:46.489954
End Date & Time: 07/02/2007 16:56:47.689954
File Duration: 1 Sec(s) - 200 Mills(s)
Sampling Frequency: 1000.000000, 1000.000 Microsecond Rate
Line Frequency: 50.000000

```

* Fault Information: *

Trigger = <?xml version="1.0" encoding="ISO-8859-1"?>

* Maximum/Minimum Analog Summary: *

| > | Max-Inst | Min-Inst | Max-RMS | Min-RMS | One-Bit | Inst-Diff | RMS-Diff | pUnits | Description |
|---|------------|-------------|------------|-----------|---------|-----------|------------|--------|--------------|
| | 2674.933 | -2687.893 | 1904.204 | 7.251 | 0.0820 | 12.961 | 1896.954 | A | 1-LINE_A_IL1 |
| | 3571.521 | -2744.666 | 2209.901 | 0.995 | 0.1090 | 826.855 | 2208.906 | A | 2-LINE_A_IL2 |
| | 376.970 | -277.766 | 231.861 | 0.429 | 0.0115 | 99.204 | 231.432 | A | 3-LINE_A_IL3 |
| | 2536.744 | -2108.160 | 1686.483 | 4.405 | 0.0774 | 428.584 | 1682.077 | A | 4-LINE_A_IN |
| | 190998.679 | -190270.055 | 161791.953 | 2064.871 | 5.8290 | 728.624 | 159727.082 | V | 5-LINE_UL1 |
| | 206770.124 | -191839.917 | 191789.438 | 3293.802 | 6.3103 | 14930.208 | 188495.636 | V | 6-LINE_UL2 |
| | 196371.696 | -197039.177 | 141351.531 | 63349.590 | 6.0133 | 667.481 | 78001.941 | V | 7-LINE_UL3 |
| | 223902.907 | -221449.795 | 154206.313 | 372.309 | 6.8332 | 2453.113 | 153834.003 | V | 8-LINE_UN |

* Events/Sensors Activity Summary: *

| >Fst | Lst | Fst-Change | Lst-Change | Changes | Description |
|------|-----|-----------------|-----------------|---------|-----------------|
| N | N | 16:56:47.140954 | 16:56:47.290954 | 002 | 1-TRIP_TRIP |
| N | N | 16:56:47.140954 | 16:56:47.290954 | 002 | 2-TRIP_L1 |
| N | N | 16:56:46.741954 | 16:56:47.188954 | 008 | 8-ZM02-START |
| N | N | 16:56:46.690954 | 16:56:47.191954 | 002 | 10-ZM03-START |
| N | N | 16:56:46.741954 | 16:56:47.194954 | 008 | 17-PHS-STFWL1 |
| N | N | 16:56:47.017954 | 16:56:47.113954 | 002 | 18-PHS-STFWL2 |
| N | N | 16:56:46.741954 | 16:56:47.194954 | 008 | 20-PHS-STFWPE |
| N | N | 16:56:47.131954 | 16:56:47.219954 | 002 | 21-ZCOM_TRIP |
| N | N | 16:56:47.138954 | 16:56:47.219954 | 002 | 35-AR01-START |
| A | A | xx:xx:xx.xxxxxx | xx:xx:xx.xxxxxx | 000 | 60-AR01_P3PH |
| A | A | xx:xx:xx.xxxxxx | xx:xx:xx.xxxxxx | 000 | 61-TEST_MODE_ON |
| N | N | 16:56:47.091954 | 16:56:47.272954 | 002 | 68-ZCOM_CR |

Grid Incidence at 220 kV Nasik GCR Sub-station on 18th March 2016

Event Category: GI-1

Event Date and Time: 18th March 2016, 14:30 Hrs.

Event Summary: Due to DC leakage, the Bus bar protection for 220 kV Bus section 3 of Nasik GCR sub-station got operated. This led to tripping of 220 kV Nasik-Bableshwar 2 and Nasik Unit 5. Tripping of Unit has resulted in loss of 140 MW generation.

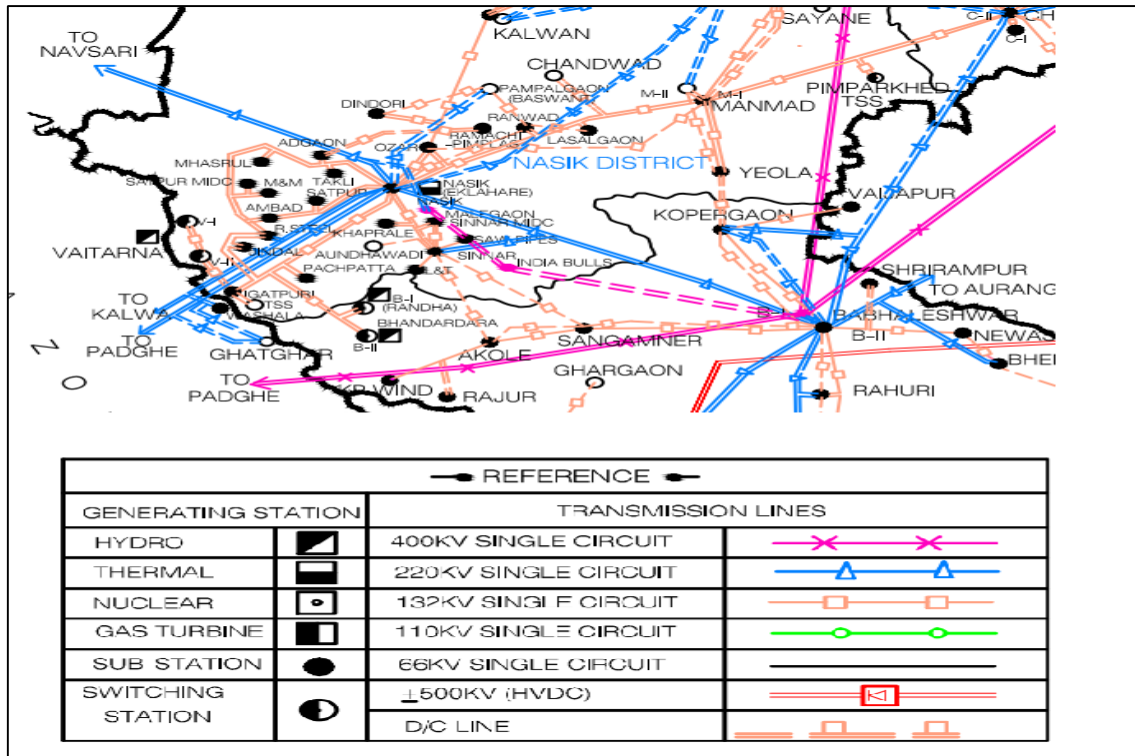


Figure 1 : Geographical Map

Event Analysis: Detailed Report from MSETCL is attached as annexure.



MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO.LTD.

| | |
|--|--|
| From: Name of Office: Superintending Engineer | To, The Chief Engineer, Trans O&M, MSETCL, C.O. Mumbai. |
| Office address: Testing & Telecommunication Circle Block No.12 MSETCL Admin Bldg. Racca Plot, Old Saykheda Road, Jail Road, Nashik (422101) | |
| Contact No: 2403181 | |
| Email Id: se5500@mahatransco.in | |

Ref. No. SE/TCC/NSK/T/ No. **No 133-3** Date: **22 MAR 2016.**

Sub: Occurrence report of operation of BB tripping relay at 220kV GCR Eklahare .

On dated 18/03/16 at 14:30 hrs at 220kV GCR Eklahare Ss Busbar trip relays operated without any indications causing tripping of following feeders

| Sr. no. | Name of Bay | R.I. | LBT in MW | Remark | Restoration time |
|---------|--------------------|------|-----------|----------------|------------------|
| 1 | 220kV Babhaleshwar | 96 | 107I | On TBC in BS-I | 15:06 |
| 2 | GT-5 | 96 | 149I | | 19:07 |
| 3 | Bus section-3 | 96 | 149E | | 14:54 |

Analysis:

After the occurrence, switchyard was inspected and no abnormality was found. These feeders were connected to bus section-3. This tripping occurred due to operation of bus bar tripping relay 96. However there is no mal-operation of bus bar or LBB protection. These relay get operated directly due charging of tripping bus of these relays. For this unwarranted tripping of 96 relays, checking of the panel where the relays installed carried out. While checking DC voltages with respect to earth was measured and found positive voltage with respect to ground is zero.

This DC earth leakage remained un-noticed as the DC earth leakage monitoring meter installed was of inadequate range i.e. instead of 10mA range, meter with range 100mA was used. This DC earth leakage might have cause the problem.

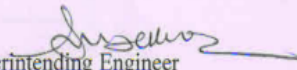
Generation loss: **149MW**

Remedial measures:

- 1) This DC earth leakage problem attended on the 21/03/16
- 2) In-adequate range DC earth leakage meter replaced with new meter.

Submitted for information and necessary action please.

Encls: SLD


Superintending Engineer
TCC, MSETCL Nashik

Copy s.w.rs.to :

- 1) The Chief Engineer, EHV CC O&M Zone, MSETCL, Nashik.
- 2) The Chief Engineer, SLDC, MSETCL, Kalwa.

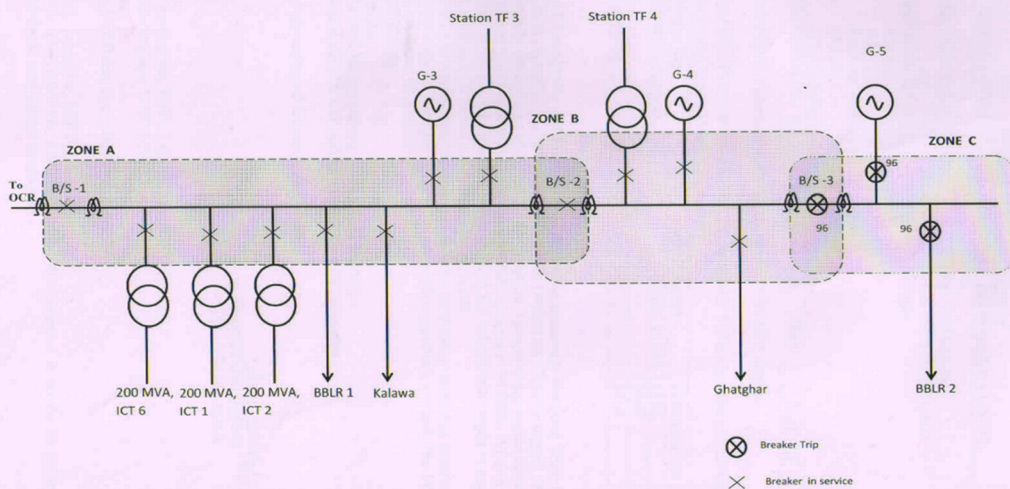
Copy f.w.cs.to :

- 1) The S.E., EHV O &M, Circle, MSETCL, Nashik.


Copy to:

- 1) The E.E., Testing Dn., MSETCL, Nashik.
- 2) The E.E., EHV O&M Dn., MSETCL, Nashik....It is requested to ask the S/s In-charge to monitor the DC earth leakage scrupulously.

SLD showing Occurrence due to Mal-operation of 96 relays on dtd 18/03/16 at 14:30hrs at 220 kV GCR Eklahare S.S.



Annexure: Report from MEGPTCL

| | | | |
|---|---|---|--|
|  | | Detailed Tripping Report of 765 kV Bus Bar Protection at Koradi-III due to 710 bay CT failure with Tiroda Koradi-3 Line -1 Tripping on 29/03/16 at 08:40:23 Hrs. | |
| Substation :- 400 kV/765 kV MEGPTCL, Koradi -III | | | |
| 400kV/765kV Adani Power Maharashtra Limited , Tiroda | | | |
| Affected Line/Equipment :- 765kV Tiroda- Koradi 3 Line -1, Koradi bay 710 R-Ph CT | | | |
| Disturbance :- | | | |
| Koradi End;- 765 kV BUS-1, Bus bar protection operated Due to Fault in R-Ph CT Bay 710 (Koradi-Tiroda line-1). Along with Bus Bar Operation, Line distance protection Zone -1 R Phase operated with Carrier Send in Both Channel.Main CB Three Phase trip Operated due to operation of Bus Bar Protection, whereas Tie CB AR operated as per Scheme, Subsequently after Tie CB AR operation -Distance protection Zone-1 R-ph and BAY 710 End fault protection operated with DT Send to Tiroda END Due to persisting fault. | | | |
| Tiroda End:- ZCOM trip operated with 1st cycle AR operation, Subsequently 3 Phase trip operated Due to persisting Fault & DT Received from Koradi End. | | | |
| Disturbance Date/Time :- 29.03.2016 08:40:23 Hrs. | | | |
| 1. | Weather Condition | Clear Weather. | |
| 2. | Generation affected & duration of interruption | NIL | |
| 3. | Sequence of Events with time Koradi End (Detail event and DR are attached) | 08:40:23.532 BBP trip zone 1 L1 08:40:23.536 Zone-4 Start 08:40:23.628 710 Breaker position indication 08:40:23.631 Zone-1 RPH Trip 08:40:23.631 Aided Trip Send Channel-1 08:40:23.631 Aided Trip Send Channel-1 08:40:24.649 711 AR close Command 08:40:24.709 Zone-2/3 Start 08:40:24.711 Zone-4 start 08:40:24.712 Zone-1 Trip/ Aided Trip Send 08:40:24.714 BAY 710 EFP Trip 08:40:24.736 BAY 711 86A /86B operated 08:40:24.748 DTS | |
| 4. | Sequence of Events with time Tiroda End (Detail event and DR are attached) | 08:40:23:541 Dist. Zone -2/3/5 start 08:40:23:642 Carrier Receive -1/2 08:40:23:645 ZCOM Trip , R-Phase Trip 08:40:23:649 Zone-2 Opted | |

| | | <p>08:40:23:685 R-phase Main CB open</p> <p>08:40:23:686 R-phase Tie CB open</p> <p>08:40:24:728 ZCOM Trip</p> <p>08:40:24:756 86A/86B Opted</p> <p>08:40:24:793 All main & tie CB open.</p> | | | | | | | | | |
|------|---|--|--|--------|--------|------|--|--|------|--|--|
| 5. | <p>Details of relays & flag at Koradi End</p> <p>(Detail event and DR are attached)</p> | <p>Bus Bar Operated</p> <p>Zone-1 R-Ph Trip Operated</p> <p>End Fault operated</p> <p>DT send</p> <p>AR Lockout</p> | | | | | | | | | |
| 6. | <p>Details of relays & flag at Tirora End</p> <p>(Detail event and DR are attached)</p> | <p>Zone -2 Operated (M1 & M2)</p> <p>ZCOM Trip</p> <p>R – Phase Trip (M1 & M2)</p> <p>Carrier Received (M1 & M2)</p> <p>DT receive</p> <p>AR Lockout</p> | | | | | | | | | |
| 7. | <p>Distance & Fault Current Recorded at Tirora End</p> | <p>Fault Current – 2.6 KA</p> <p>Distance – M1-138 km & M2- 141.6 km.</p> | | | | | | | | | |
| 8. | <p>Distance & Fault Current Recorded at Koradi End</p> | <p>Fault Current - 11.5 KA</p> <p>Distance M1 – 28.5 & 0.0 km</p> | | | | | | | | | |
| 9. | <p>Carrier RX/TX CH-1/CH-2 Before & After fault</p> | <p>Increment in Carrier Signals Counter</p> <table border="1"> <thead> <tr> <th></th> <th>Koradi</th> <th>Tiroda</th> </tr> </thead> <tbody> <tr> <td>CH-1</td> <td> <p>A- RX-0 TX -2</p> <p>B - RX-0 TX-3</p> <p>C - RX-1 TX-1</p> </td> <td> <p>A- RX-2 TX -0</p> <p>B - RX-3 TX-0</p> <p>C - RX-1 TX-1</p> </td> </tr> <tr> <td>CH-2</td> <td> <p>A- RX-0 TX -2</p> <p>B - RX-0 TX-3</p> <p>C - RX-1 TX-1</p> </td> <td> <p>A- RX-2 TX -0</p> <p>B - RX-3 TX-0</p> <p>C - RX-1 TX-1</p> </td> </tr> </tbody> </table> | | Koradi | Tiroda | CH-1 | <p>A- RX-0 TX -2</p> <p>B - RX-0 TX-3</p> <p>C - RX-1 TX-1</p> | <p>A- RX-2 TX -0</p> <p>B - RX-3 TX-0</p> <p>C - RX-1 TX-1</p> | CH-2 | <p>A- RX-0 TX -2</p> <p>B - RX-0 TX-3</p> <p>C - RX-1 TX-1</p> | <p>A- RX-2 TX -0</p> <p>B - RX-3 TX-0</p> <p>C - RX-1 TX-1</p> |
| | Koradi | Tiroda | | | | | | | | | |
| CH-1 | <p>A- RX-0 TX -2</p> <p>B - RX-0 TX-3</p> <p>C - RX-1 TX-1</p> | <p>A- RX-2 TX -0</p> <p>B - RX-3 TX-0</p> <p>C - RX-1 TX-1</p> | | | | | | | | | |
| CH-2 | <p>A- RX-0 TX -2</p> <p>B - RX-0 TX-3</p> <p>C - RX-1 TX-1</p> | <p>A- RX-2 TX -0</p> <p>B - RX-3 TX-0</p> <p>C - RX-1 TX-1</p> | | | | | | | | | |
| 10. | <p>Brief details of restoration</p> | <p>Line was charged After isolation of 710 Bay at Koradi End at 12:46 Hrs.</p> | | | | | | | | | |
| 11. | <p>Event Log & Disturbance Files</p> | <ol style="list-style-type: none"> 1. DR PC Event Log 2. M1 relay DR 3. M2 relay DR 4. Koradi BB DR | | | | | | | | | |

| | | |
|-----|----------|--|
| 12. | Analysis | <ul style="list-style-type: none"> - Operation of Busbar protection due to failure of R Phase CT of 710 bay is in order for Main-1 and Main-2. - The failed CT is located between Main and Tie CB. - Simultaneous to above operation of distance protection Zone-1 of Tiroda – Koradi-3 operated, being fault at origin point with carrier signal send. - At remote end ZCOM protection operated for both M-1 & M-2 relays with Z-2 start and CR. - Auto reclosing cycle performed at both ends and resulted in to three phase lock out as was persistent fault due to location of failed CT between Main and Tie breaker. - The 710 Main breaker locked out due to Three phase trip operation. Tie breaker 711 performed AR as per scheme but locked out as said above. - On reclosing of 711 CB at Koradi, the END fault protection operated for 710 bay, fulfilling the condition for CB open and flow of current, initiating DT signal from Koradi to Tiroda also. - - Reason of R-ph Bay 710 at Koradi substation is under investigation. <p>Operation of protection system at both end MEGPTCL koradi-III and APML Tiroda found in order as per scheme and requirement.</p> |
|-----|----------|--|

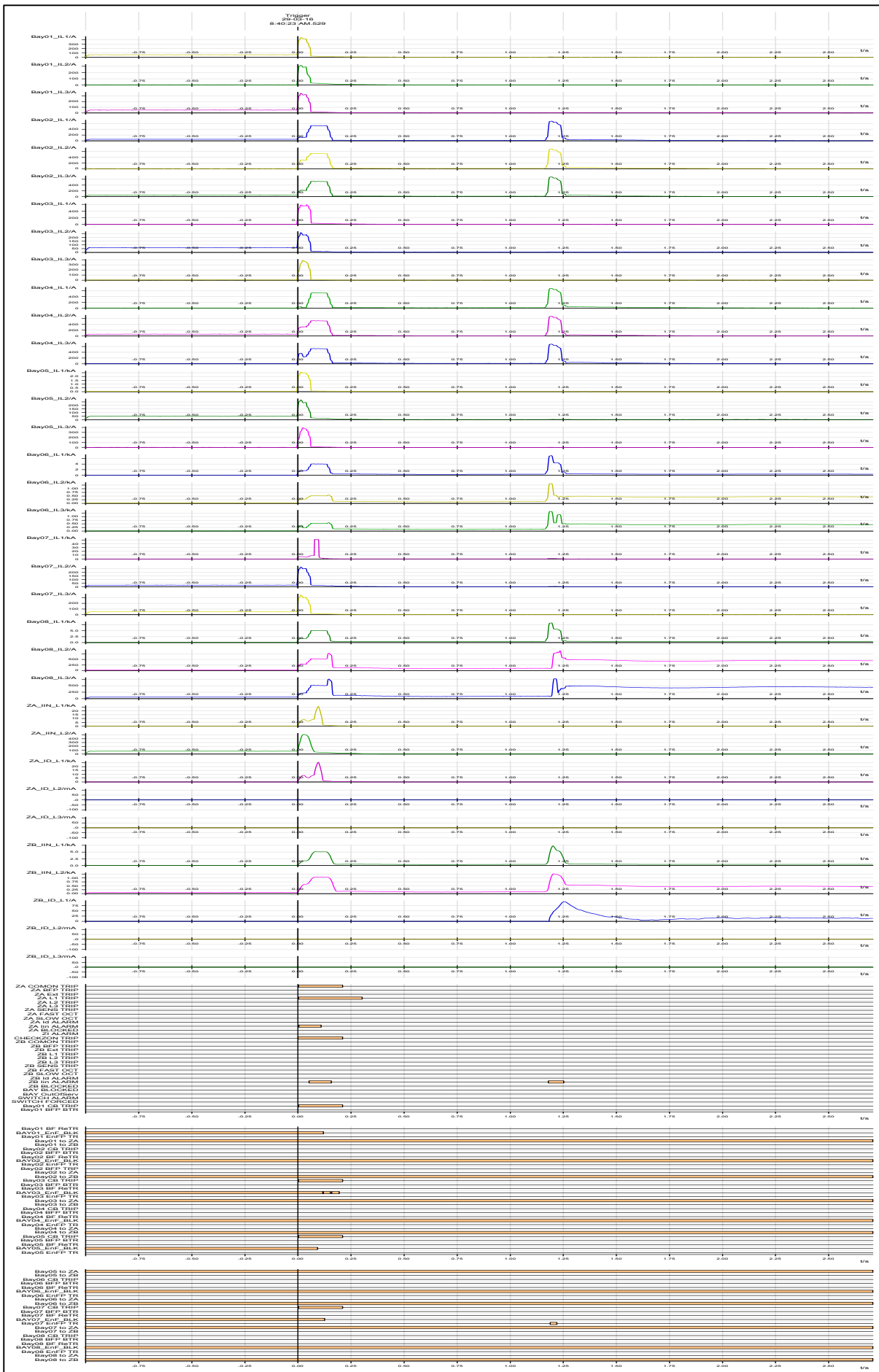


Fig: Bus bar Protection Relay DR

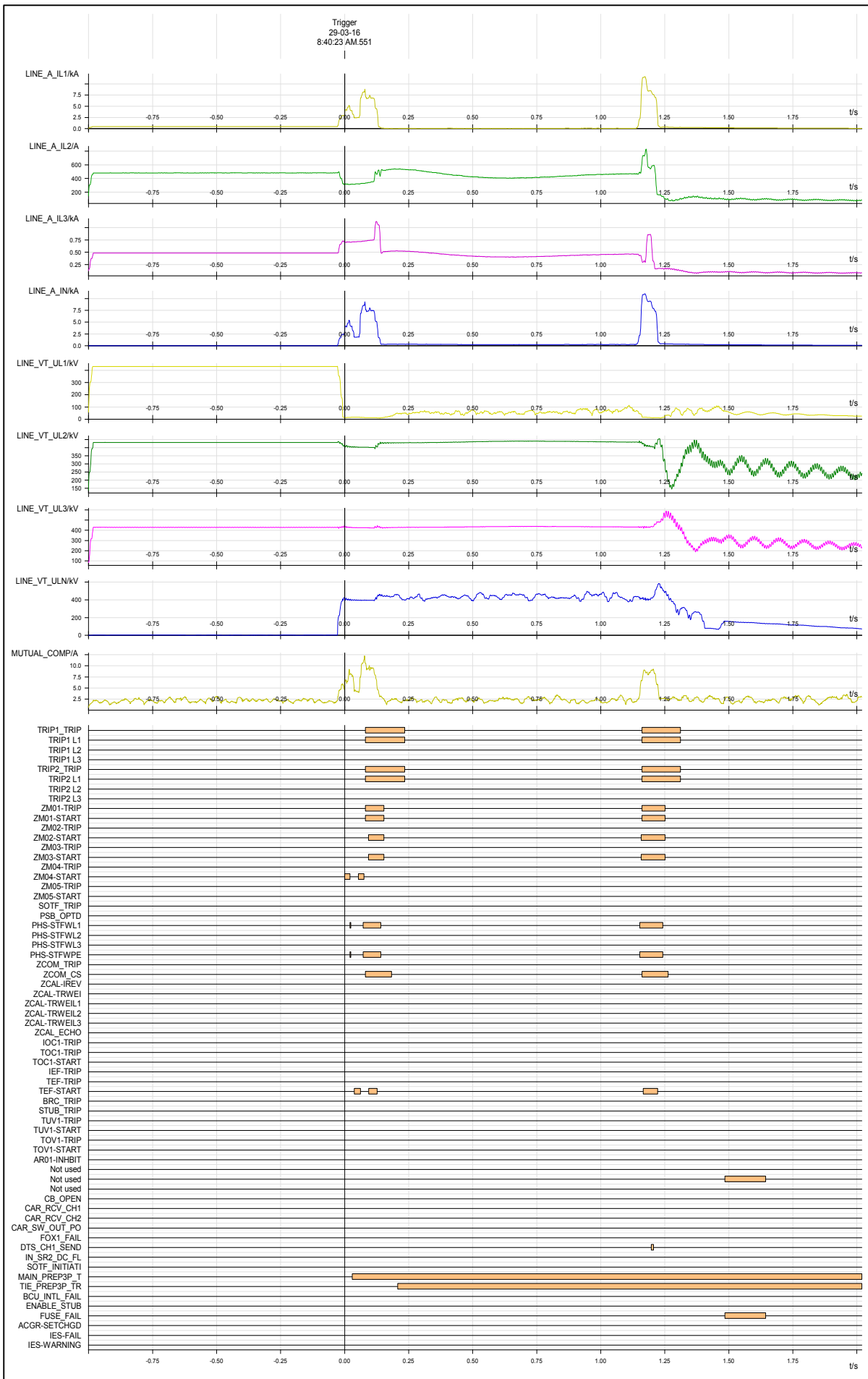


Fig: 765 kV Koradi3-Tirora ckt 2 DR from Koradi 3 end.

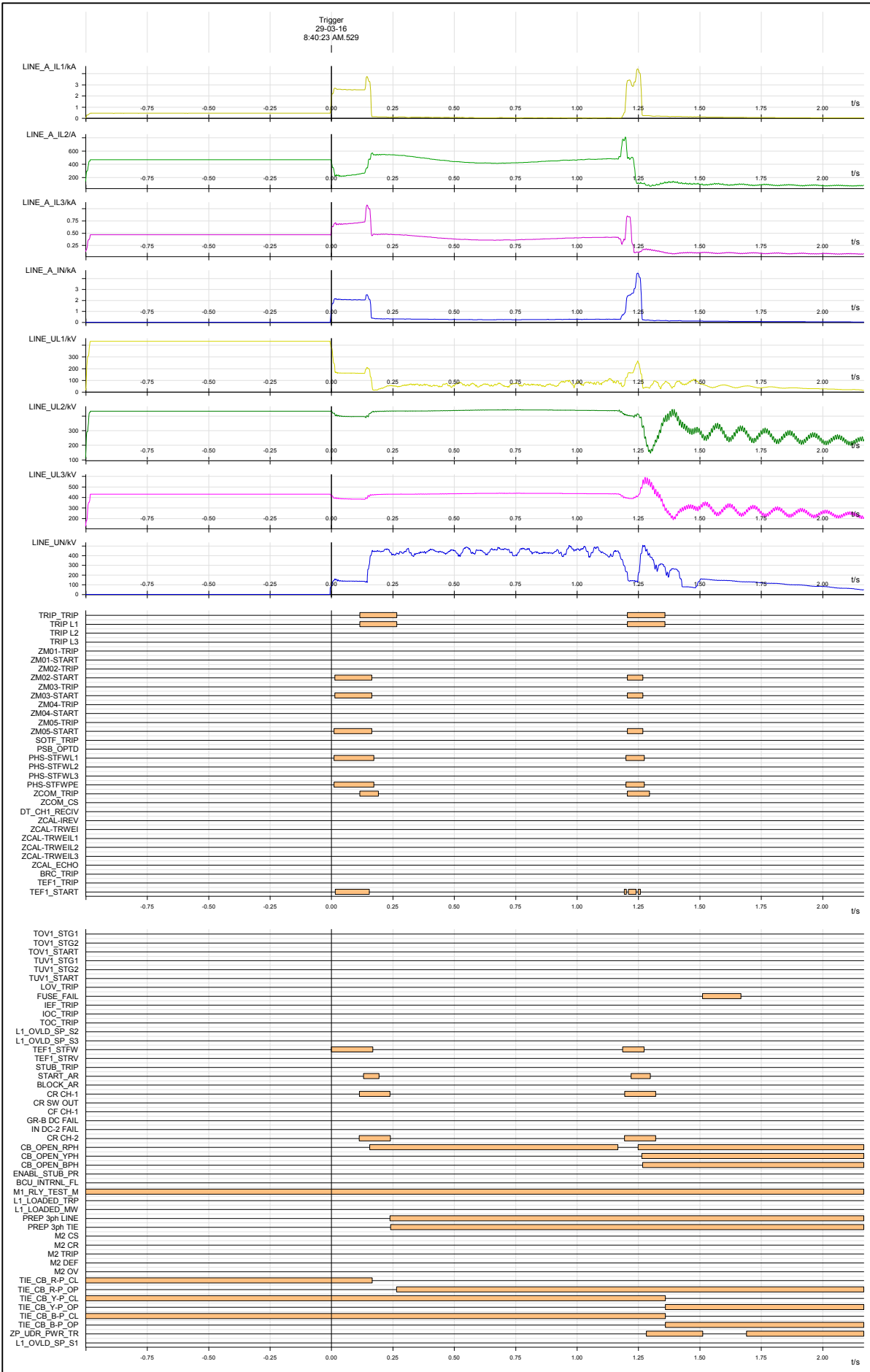


Fig: 765 kV Koradi3-Tirora ckt 2 DR from Tirora end.

| StartTime | Plant | Channel | Unit | Tag No | Message Description | Alarm Identifier |
|-------------------------|--------|----------|----------|----------|-------------------------------|------------------|
| 2016-03-29 08:40:30.205 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Fault Loc. Dist. in km | 0.0 km |
| 2016-03-29 08:40:26.302 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Fault Loc. Dist. in km | 28.5 km |
| 2016-03-29 08:40:25.778 | KORADI | ABB-SAS2 | 712 SS2 | REL M1 | FOX-1 CH-1 Carrier Status | Faulty |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send Channel-2 | On |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send Channel-1 | On |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Protection Trip R-Ph | On |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS2 | P444 M2 | Zone-1 RPH Trip | Alarm |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Zone-1 | Operated |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS2 | P444 M2 | Zone-1 RPH Start | Alarm |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Zone-1 Start | Alarm |
| 2016-03-29 08:40:24.716 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 710 LBB Rph initiation | Alarm |
| 2016-03-29 08:40:24.716 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 710 LBB Rph initiation | Alarm |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send | Alarm |
| 29-03-16 08:40:24.711 | KORADI | ABB-SAS2 | 707 SS1A | P444 M2 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:24.723 | KORADI | ABB-SAS2 | 712 SS2 | P444 M2 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:24.726 | KORADI | ABB-SAS2 | 712 SS2 | REL M1 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:24.718 | KORADI | ABB-SAS2 | 712 SS2 | REL M1 | Directional Earth Fault Start | Alarm |
| 2016-03-29 08:40:24.746 | KORADI | ABB-SAS2 | 765BB | REBM1 | BAY 710 EFP Trip | Normal |
| 2016-03-29 08:40:24.746 | KORADI | ABB-SAS2 | 765BB | REBM1 | BAY 710 EFP Start | Normal |
| 2016-03-29 08:40:24.742 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | CB not ready | Alarm |
| 2016-03-29 08:40:24.736 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | LBB initiation 3ph | Alarm |
| 2016-03-29 08:40:24.743 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | Bph LBB initiation | Alarm |
| 2016-03-29 08:40:24.728 | KORADI | ABB-SAS2 | 709 SS2 | REL M1 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:24.742 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | Yph LBB initiation | Alarm |
| 2016-03-29 08:40:24.736 | KORADI | ABB-SAS2 | 711 TIE | TRSM2 | 86B | Operated |
| 29-03-16 08:40:24.736 | KORADI | ABB-SAS2 | 711 TIE | TRSM1 | 86A | Operated |
| 2016-03-29 08:40:24.745 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR Unsuccessful | Alarm |
| 2016-03-29 08:40:24.711 | KORADI | ABB-SAS2 | 711 TIE | Q52 | Breaker position indication | Closed |
| 2016-03-29 08:40:24.742 | KORADI | ABB-SAS2 | 711 TIE | Q52 | Breaker close interlocked | On |
| 2016-03-29 08:40:24.720 | KORADI | ABB-SAS2 | 709 SS2 | RET DIFF | E/F prot start | Alarm |
| 2016-03-29 08:40:24.742 | KORADI | ABB-SAS2 | 711 TIE | Q52 | Breaker open interlocked | Off |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 710 SS1A | REC 670 | AR Start | Alarm |
| 2016-03-29 08:40:24.727 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | AR Start TIE | Alarm |
| 2016-03-29 08:40:24.727 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | AR Start Main | Alarm |
| 2016-03-29 08:40:24.712 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send Channel-2 | Alarm |
| 2016-03-29 08:40:24.712 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send Channel-1 | Alarm |
| 29-03-16 08:40:24.712 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send | Alarm |
| 2016-03-29 08:40:24.712 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-1 | Operated |
| 2016-03-29 08:40:24.712 | KORADI | ABB-SAS2 | 710 SS2 | REL M1 | Zone-1 RPH Start | Alarm |
| 2016-03-29 08:40:24.712 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-1 Start | Alarm |
| 2016-03-29 08:40:24.717 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Directional Earth Fault Start | Alarm |
| 2016-03-29 08:40:24.712 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Protection Trip R-Phase | Alarm |
| 2016-03-29 08:40:24.709 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-3 Start | Alarm |
| 2016-03-29 08:40:24.709 | KORADI | ABB-SAS2 | 710 SS2 | REL M1 | Zone-2 RPH Start | Alarm |
| 29-03-16 08:40:24.709 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-2 Start | Alarm |
| 2016-03-29 08:40:24.731 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR Start from M1/M2 for TIROD | Alarm |
| 2016-03-29 08:40:24.716 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | Rph LBB initiation | Alarm |
| 2016-03-29 08:40:24.718 | KORADI | ABB-SAS2 | 765BB | REBM2 | BAY 710 EFP Trip | Alarm |
| 2016-03-29 08:40:24.718 | KORADI | ABB-SAS2 | 765BB | REBM2 | BAY 710 EFP Start | Alarm |
| 29-03-16 08:40:24.714 | KORADI | ABB-SAS2 | 765BB | REBM1 | BAY 710 EFP Trip | Alarm |
| 2016-03-29 08:40:24.714 | KORADI | ABB-SAS2 | 765BB | REBM1 | BAY 710 EFP Start | Alarm |
| 2016-03-29 08:40:24.721 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR Successful | Alarm |
| 2016-03-29 08:40:24.710 | KORADI | ABB-SAS2 | 712 SS2 | P444 M2 | General Protection Start | Alarm |
| 2016-03-29 08:40:24.710 | KORADI | ABB-SAS2 | 712 SS2 | P444 M2 | Directional Earth Fault Stage | Alarm |
| 2016-03-29 08:40:24.656 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR in progress | Normal |
| 29-03-16 08:40:24.649 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR close Command | Alarm |
| 2016-03-29 08:40:24.603 | KORADI | ABB-SAS2 | 712 SS2 | P444 M2 | FOX-2 CH-2 Carrier Status | Faulty |
| 2016-03-29 08:40:23.711 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | General Protection Trip | Normal |
| 2016-03-29 08:40:23.690 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send | Normal |
| 2016-03-29 08:40:23.690 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send Channel-2 | Off |
| 2016-03-29 08:40:23.690 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send Channel-1 | Off |
| 2016-03-29 08:40:23.711 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Protection Trip R-Ph | Off |
| 2016-03-29 08:40:23.686 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Stub protection start | Normal |
| 2016-03-29 08:40:23.747 | KORADI | ABB-SAS2 | 707 SS1A | REC 670 | BB / LBB | Normal |
| 2016-03-29 08:40:23.680 | KORADI | ABB-SAS2 | 710 SS2 | P444 M2 | Zone-1 RPH Trip | Normal |
| 2016-03-29 08:40:23.680 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Zone-1 | Normal |
| 2016-03-29 08:40:23.680 | KORADI | ABB-SAS2 | 710 SS2 | P444 M2 | Zone-1 RPH Start | Normal |
| 2016-03-29 08:40:23.680 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Zone-1 Start | Normal |
| 2016-03-29 08:40:23.631 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send Channel-2 | On |
| 2016-03-29 08:40:23.631 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send Channel-1 | On |
| 29-03-16 08:40:23.631 | KORADI | ABB-SAS2 | 710 SS2 | P444 M2 | Zone-1 RPH Trip | Alarm |

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| 2016-03-29 08:40:23.631 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Zone-1 | Operated |
| 2016-03-29 08:40:23.631 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Aided Trip Send | Alarm |
| 2016-03-29 08:40:23.631 | KORADI | ABB-SAS2 | 710 SS2 | P444 M2 | Zone-1 RPH Start | Alarm |
| 2016-03-29 08:40:23.631 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Zone-1 Start | Alarm |
| 2016-03-29 08:40:23.628 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Zone-4 Start | Normal |
| 2016-03-29 08:40:23.720 | KORADI | ABB-SAS2 | 707 SS1A | REL M1 | Over Voltage Start | Normal |
| 2016-03-29 08:40:23.687 | KORADI | ABB-SAS2 | 707 SS1A | P444 M2 | Zone-4 Start | Normal |
| 2016-03-29 08:40:23.685 | KORADI | ABB-SAS2 | 707 SS1A | P444 M2 | Stub protection start | Alarm |
| 2016-03-29 08:40:23.682 | KORADI | ABB-SAS2 | 712 SS2 | P444 M2 | Directional Earth Fault Stage | Normal |
| 2016-03-29 08:40:23.681 | KORADI | ABB-SAS2 | 712 SS2 | P444 M2 | Stub protection start | Normal |
| 2016-03-29 08:40:23.842 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 710 breaker failure retri | Normal |
| 2016-03-29 08:40:23.832 | KORADI | ABB-SAS2 | 765BB | REBM2 | BBP trip zone 1 L1 | Normal |
| 2016-03-29 08:40:23.788 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 710 LBB Rph initiation | Normal |
| 2016-03-29 08:40:23.824 | KORADI | ABB-SAS2 | 765BB | REBM1 | BBP trip zone 1 L1 | Normal |
| 2016-03-29 08:40:23.788 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 710 LBB Rph initiation | Normal |
| 2016-03-29 08:40:23.683 | KORADI | ABB-SAS2 | 709 SS2 | P444 M2 | Over Voltage Stage-1 Start | Normal |
| 2016-03-29 08:40:23.683 | KORADI | ABB-SAS2 | 709 SS2 | P444 M2 | General Protection Start | Normal |
| 2016-03-29 08:40:23.750 | KORADI | ABB-SAS2 | 710 SS1A | REC 670 | BB / LBB | Normal |
| 2016-03-29 08:40:23.709 | KORADI | ABB-SAS2 | 710 SS1A | REC 670 | AR Start | Normal |
| 2016-03-29 08:40:23.684 | KORADI | ABB-SAS2 | 707 SS1A | P444 M2 | Directional Earth Fault Stage | Normal |
| 2016-03-29 08:40:23.745 | KORADI | ABB-SAS2 | 701 AT1 | REC | 87BB2/LBB2 | Normal |
| 2016-03-29 08:40:23.742 | KORADI | ABB-SAS2 | 701 AT1 | REC | 87BB1/LBB1 | Normal |
| 2016-03-29 08:40:23.743 | KORADI | ABB-SAS2 | 704 AT2 | REC | 87BB2/LBB2 | Normal |
| 2016-03-29 08:40:23.742 | KORADI | ABB-SAS2 | 704 AT2 | REC | 87BB1/LBB1 | Normal |
| 2016-03-29 08:40:23.734 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send Channel-2 | Normal |
| 2016-03-29 08:40:23.734 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send Channel-1 | Normal |
| 2016-03-29 08:40:23.734 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send | Normal |
| 2016-03-29 08:40:23.681 | KORADI | ABB-SAS2 | 709 SS2 | P444 M2 | Stub protection start | Normal |
| 2016-03-29 08:40:23.707 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | AR Start TIE | Normal |
| 2016-03-29 08:40:23.710 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR Start from M1/M2 for TIROD | Normal |
| 2016-03-29 08:40:23.707 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | AR Start Main | Normal |
| 2016-03-29 08:40:23.679 | KORADI | ABB-SAS2 | 711 TIE | Q52 | Breaker position indication | Intermediate |
| 2016-03-29 08:40:23.704 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-3 Start | Normal |
| 2016-03-29 08:40:23.739 | KORADI | ABB-SAS2 | 765BB | REBM2 | BFP Genral trip Zone-1 | Normal |
| 2016-03-29 08:40:23.704 | KORADI | ABB-SAS2 | 710 SS2 | REL M1 | Zone-2 RPH Start | Normal |
| 2016-03-29 08:40:23.704 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-2 Start | Normal |
| 2016-03-29 08:40:23.739 | KORADI | ABB-SAS2 | 765BB | REBM2 | Check Zone Trip R-Ph | Normal |
| 2016-03-29 08:40:23.739 | KORADI | ABB-SAS2 | 765BB | REBM2 | Check Zone Trip | Normal |
| 2016-03-29 08:40:23.739 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 710 Trip | Normal |
| 2016-03-29 08:40:23.739 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 707 Trip | Normal |
| 2016-03-29 08:40:23.704 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-1 | Normal |
| 2016-03-29 08:40:23.739 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 704 Trip | Normal |
| 2016-03-29 08:40:23.739 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 701Trip | Normal |
| 2016-03-29 08:40:23.737 | KORADI | ABB-SAS2 | 765BB | REBM1 | BFP Genral trip Zone-1 | Normal |
| 2016-03-29 08:40:23.704 | KORADI | ABB-SAS2 | 710 SS2 | REL M1 | Zone-1 RPH Start | Normal |
| 2016-03-29 08:40:23.704 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-1 Start | Normal |
| 2016-03-29 08:40:23.737 | KORADI | ABB-SAS2 | 765BB | REBM1 | Check Zone Trip R-Ph | Normal |
| 2016-03-29 08:40:23.737 | KORADI | ABB-SAS2 | 765BB | REBM1 | Check Zone Trip | Normal |
| 2016-03-29 08:40:23.636 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 710 LBB Rph initiation | Alarm |
| 2016-03-29 08:40:23.737 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 710 Trip | Normal |
| 2016-03-29 08:40:23.737 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 707 Trip | Normal |
| 2016-03-29 08:40:23.737 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 704 Trip | Normal |
| 2016-03-29 08:40:23.737 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 701Trip | Normal |
| 2016-03-29 08:40:23.688 | KORADI | ABB-SAS2 | 712 SS2 | REL M1 | Zone-4 Start | Normal |
| 2016-03-29 08:40:23.696 | KORADI | ABB-SAS2 | 707 SS1A | REC 670 | 89A Pole Discordance | Alarm |
| 2016-03-29 08:40:23.687 | KORADI | ABB-SAS2 | 709 SS2 | REL M1 | Zone-4 Start | Normal |
| 2016-03-29 08:40:23.600 | KORADI | ABB-SAS2 | 708 TIE | REC 670 | Tiroda-1 Main CB OPEN | Alarm |
| 29-03-16 08:40:23.590 | KORADI | ABB-SAS2 | 707 SS1A | Q52 | Breaker position indication | Open |
| 2016-03-29 08:40:23.645 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Directional Earth Fault Start | Alarm |
| 2016-03-29 08:40:23.653 | KORADI | ABB-SAS2 | 710 SS1A | TRSM2 | 86B | Operated |
| 29-03-16 08:40:23.653 | KORADI | ABB-SAS2 | 710 SS1A | TRSM1 | 86A | Operated |
| 29-03-16 08:40:23.628 | KORADI | ABB-SAS2 | 710 SS1A | Q52 | Breaker position indication | Open |
| 2016-03-29 08:40:23.638 | KORADI | ABB-SAS2 | 710 SS1A | REC 670 | AR Start | Alarm |
| 2016-03-29 08:40:23.647 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | AR Start TIE | Alarm |
| 2016-03-29 08:40:23.647 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | AR Start Main | Alarm |
| 2016-03-29 08:40:23.644 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-3 Start | Alarm |
| 2016-03-29 08:40:23.644 | KORADI | ABB-SAS2 | 710 SS2 | REL M1 | Zone-2 RPH Start | Alarm |
| 2016-03-29 08:40:23.644 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-2 Start | Alarm |
| 2016-03-29 08:40:23.632 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send Channel-2 | Alarm |
| 2016-03-29 08:40:23.632 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send Channel-1 | Alarm |
| 2016-03-29 08:40:23.632 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Aided Trip Send | Alarm |
| 2016-03-29 08:40:23.632 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-1 | Operated |

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| 2016-03-29 08:40:23.632 | KORADI | ABB-SAS2 | 710 SS2 | REL M1 | Zone-1 RPH Start | Alarm |
| 2016-03-29 08:40:23.632 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-1 Start | Alarm |
| 2016-03-29 08:40:23.632 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Protection Trip R-Phase | Alarm |
| 2016-03-29 08:40:23.626 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-4 Start | Normal |
| 2016-03-29 08:40:23.592 | KORADI | ABB-SAS2 | 704 AT2 | Q52 | Breaker position indication | Open |
| 2016-03-29 08:40:23.587 | KORADI | ABB-SAS2 | 765BB | REBM2 | 707-CB OPEN For EFP Protectio | Alarm |
| 2016-03-29 08:40:23.647 | KORADI | ABB-SAS2 | 765BB | REBM2 | 704-CB OPEN For EFP Protectio | Alarm |
| 2016-03-29 08:40:23.653 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 710 LBB 3ph initiation | Alarm |
| 2016-03-29 08:40:23.653 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 710 LBB 3ph initiation | Alarm |
| 2016-03-29 08:40:23.638 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR Start from M1/M2 for TIROD | Alarm |
| 2016-03-29 08:40:23.636 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | Rph LBB initiation | Alarm |
| 2016-03-29 08:40:23.648 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR in progress | Alarm |
| 2016-03-29 08:40:23.648 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | AR Ready | Normal |
| 2016-03-29 08:40:23.605 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:23.636 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 710 LBB Rph initiation | Alarm |
| 2016-03-29 08:40:23.642 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 710 breaker failure retri | Alarm |
| 2016-03-29 08:40:23.601 | KORADI | ABB-SAS2 | 405 TIE | Q52 | Breaker position indication | Open |
| 2016-03-29 08:40:23.591 | KORADI | ABB-SAS2 | 701 AT1 | Q52 | Breaker position indication | Open |
| 2016-03-29 08:40:23.599 | KORADI | ABB-SAS2 | 711 TIE | REC 670 | TIRODA Line CB open | Alarm |
| 2016-03-29 08:40:23.541 | KORADI | ABB-SAS2 | 712 SS2 | P444 M2 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:23.537 | KORADI | ABB-SAS2 | 707 SS1A | P444 M2 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:23.586 | KORADI | ABB-SAS2 | 765BB | REBM1 | 707-CB OPEN For EFP Protectio | Alarm |
| 2016-03-29 08:40:23.588 | KORADI | ABB-SAS2 | 765BB | REBM1 | 704-CB OPEN For EFP Protectio | Alarm |
| 2016-03-29 08:40:23.587 | KORADI | ABB-SAS2 | 765BB | REBM1 | 701-CB OPEN For EFP Protectio | Alarm |
| 2016-03-29 08:40:23.536 | KORADI | ABB-SAS2 | 710 SS1A | P444 M2 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:23.564 | KORADI | ABB-SAS2 | 707 SS1A | REC 670 | BB / LBB | Operated |
| 2016-03-29 08:40:23.572 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-4 Start | Normal |
| 2016-03-29 08:40:23.562 | KORADI | ABB-SAS2 | 710 SS1A | REC 670 | BB / LBB | Operated |
| 2016-03-29 08:40:23.553 | KORADI | ABB-SAS2 | 405 TIE | TRSM1 | 86A | Operated |
| 2016-03-29 08:40:23.551 | KORADI | ABB-SAS2 | 710 SS1A | REL M1 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:23.541 | KORADI | ABB-SAS2 | 701 AT1 | REC | 87BB2/LBB2 | Operated |
| 2016-03-29 08:40:23.542 | KORADI | ABB-SAS2 | 701 AT1 | REC | 87BB1/LBB1 | Operated |
| 2016-03-29 08:40:23.549 | KORADI | ABB-SAS2 | 709 SS2 | REL M1 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:23.539 | KORADI | ABB-SAS2 | 704 AT2 | REC | 87BB2/LBB2 | Operated |
| 2016-03-29 08:40:23.542 | KORADI | ABB-SAS2 | 704 AT2 | REC | 87BB1/LBB1 | Operated |
| 2016-03-29 08:40:23.528 | KORADI | ABB-SAS2 | 707 SS1A | P444 M2 | General Protection Start | Alarm |
| 2016-03-29 08:40:23.550 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bus1 trip relay | Operated |
| 2016-03-29 08:40:23.550 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bus1 trip relay | Operated |
| 2016-03-29 08:40:23.550 | KORADI | ABB-SAS2 | 712 SS2 | REL M1 | Zone-4 Start | Alarm |
| 2016-03-29 08:40:23.533 | KORADI | ABB-SAS2 | 765BB | REBM1 | BBP trip zone 1 L1 | Alarm |
| 2016-03-29 08:40:23.533 | KORADI | ABB-SAS2 | 765BB | REBM1 | BFP Genral trip Zone-1 | Alarm |
| 2016-03-29 08:40:23.530 | KORADI | ABB-SAS2 | 765BB | REBM1 | Check Zone Trip R-Ph | Alarm |
| 2016-03-29 08:40:23.530 | KORADI | ABB-SAS2 | 765BB | REBM1 | Check Zone Trip | Alarm |
| 2016-03-29 08:40:23.533 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 710 Trip | Alarm |
| 2016-03-29 08:40:23.533 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 707 Trip | Alarm |
| 2016-03-29 08:40:23.533 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 704 Trip | Alarm |
| 2016-03-29 08:40:23.533 | KORADI | ABB-SAS2 | 765BB | REBM1 | Bay 701Trip | Alarm |
| 2016-03-29 08:40:23.532 | KORADI | ABB-SAS2 | 765BB | REBM2 | BBP trip zone 1 L1 | Alarm |
| 2016-03-29 08:40:23.532 | KORADI | ABB-SAS2 | 765BB | REBM2 | BFP Genral trip Zone-1 | Alarm |
| 2016-03-29 08:40:23.529 | KORADI | ABB-SAS2 | 765BB | REBM2 | Check Zone Trip R-Ph | Alarm |
| 2016-03-29 08:40:23.529 | KORADI | ABB-SAS2 | 765BB | REBM2 | Check Zone Trip | Alarm |
| 2016-03-29 08:40:23.532 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 710 Trip | Alarm |
| 2016-03-29 08:40:23.532 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 707 Trip | Alarm |
| 2016-03-29 08:40:23.532 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 704 Trip | Alarm |
| 2016-03-29 08:40:23.532 | KORADI | ABB-SAS2 | 765BB | REBM2 | Bay 701Trip | Alarm |

Detailed report of the occurrence at 220/132 kV Urla Sub-station on 16th December 2015

1. **Event Category :** GD-1
2. **Event Date and Time :** 16th December 2015, 13:19
3. **Event Summary:** 132 kV Y phase breaker pole of 220/132 kV ICT 2 at Urla Sub-station burst resulting in bus fault at 132 kV bus of 220/132 kV Urla bus. After this all elements from 132 kV Urla Bus tripped resulting in load loss in tune of 300 MW in the area. The event caused loss of supply in Urla and Partial loss in area of Raipur, Industrial Sector C of Raipur, Borjhara, Heera and Kachana.

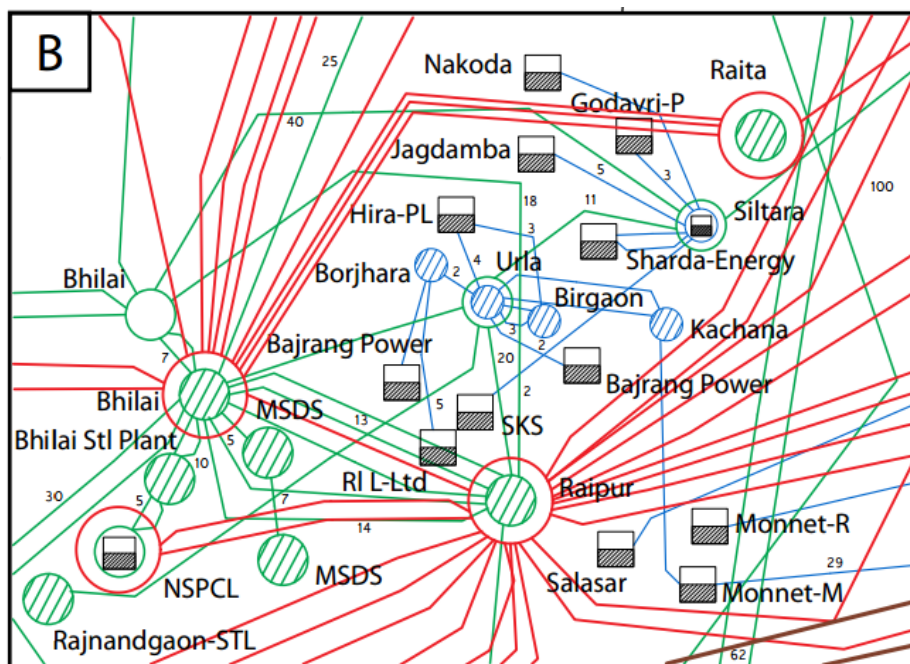


Figure 1 : Geographical Network Diagram

4. The antecedent conditions

Antecedent conditions are not available at WRLDC for the event as 220/132 kV Urla Sub-station data was suspected during the event.

5. Event Overview:

- This report is prepared based on preliminary report as no details have been submitted by CSPTCL and Chhattisgarh SLDC for this event.
- Due to burst of Y phase pole of 220/132 kV ICT, bus fault occurred on 132 kV Bus and all elements connected got tripped. The fault is on 132 kV side based on the fact that there was no 220 kV line tripping at Urla during the event. So, this suggests that the breaker which got burst was on the 132 kV side of the ICT 2.
- The protection on which the fault got cleared is not provided by CSPTCL. However, from PMU data shown in figure 2, it was observed that the fault was cleared within 160ms.

- Due to the tripping of all 220/132 kV ICTs at Urla, radial loads got tripped causing interruption of load.

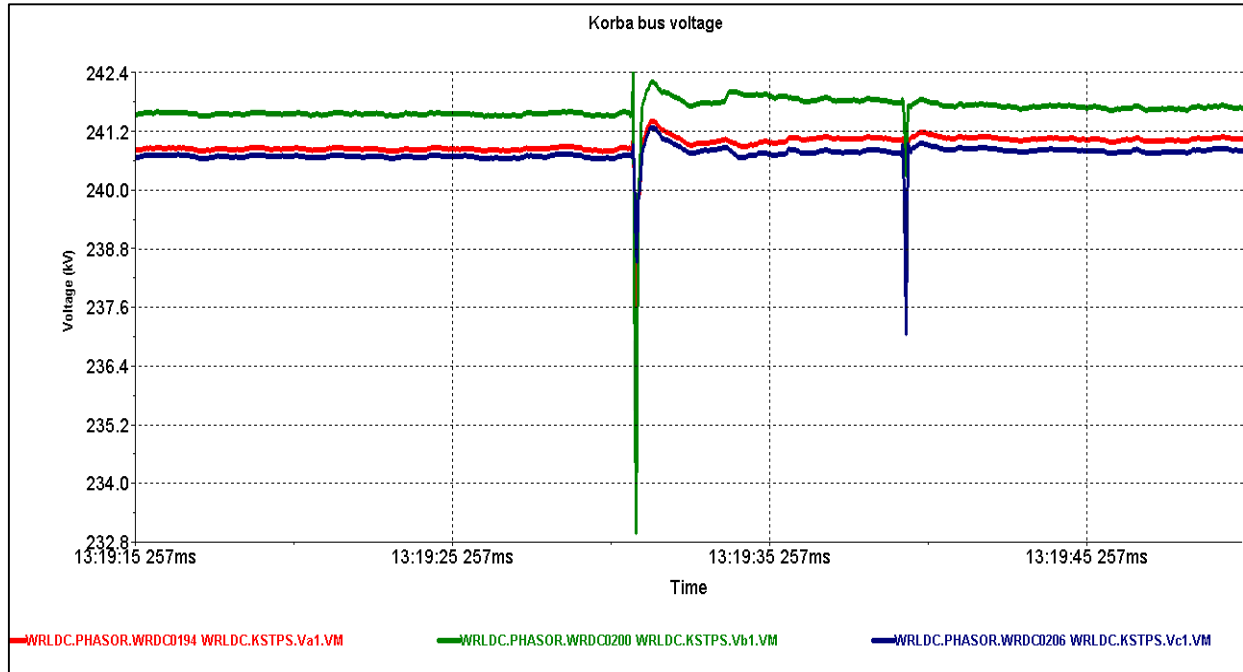


Figure 2 : 400 kV Korba Bus voltage indicating Y phase to E/f during the event.

Table 1 : The sequence of tripping and restoration

| Sl No. | Name of the transmission element/ Unit | Time of Tripping (hh:mm) | Relay indication End 1 | Relay Indication End 2 | Time of restoration (hh:mm) |
|--------|--|--------------------------|---------------------------------------|------------------------|-----------------------------|
| 1 | 220/132 kV Urla ICT 1 | 13:19 | No Details provided by CSPTCL. | | 15:15 |
| 2 | 220/132 kV Urla ICT 2 | 13:19 | | | Not Avl |
| 3 | 220/132 kV Urla ICT 3 | 13:19 | | | 15:15 |
| 4 | 132 kv Urla-Birgaon | 13:19 | | | Not Avl |
| 5 | 132 kv Urla-Sector C 1 | 13:19 | | | 17:50 |
| 6 | 132 kv Urla-Sector C 2 | 13:19 | | | 17:50 |
| 7 | 132 kV Urla-Borjhara | 13:19 | | | 15:24 |
| 8 | 132 kv Urla-Heera pooling | 13:19 | | | Not Avl |
| 9 | 132 kV Urla-Kachana 1 | 13:19 | | | Not Avl |
| 10 | 132 kV Urla-Kachana 1 | 13:19 | | | Not Avl |

Load / Generation affected: Around 278 MW load loss is expected in the area as observed from the Demand plot of chattishgarh shown in figure 3. While Chattishrah SLDC reported 300 MW load loss in the area.

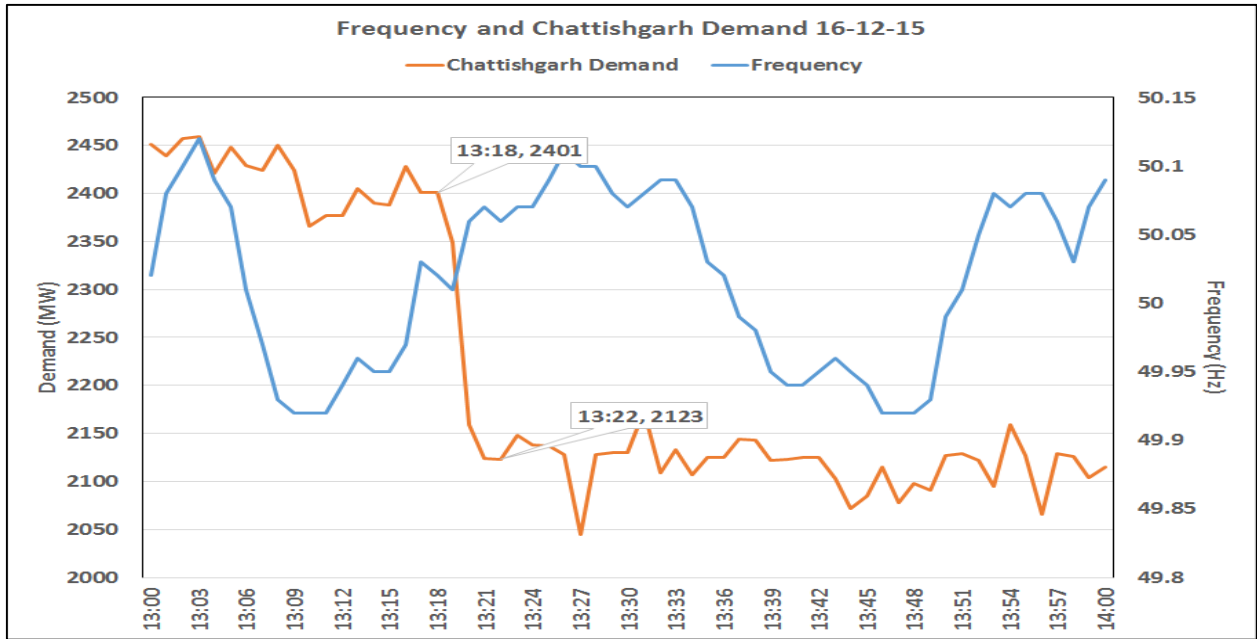


Figure 3 : Demand of Chhattisgarh and Frequency Plot during the event at Urla.

Frequency Change : Frequency has rose from 50.031 to 50.072 Hz i.e. by .041 Hz due to loss of load as observed from the attached plot.

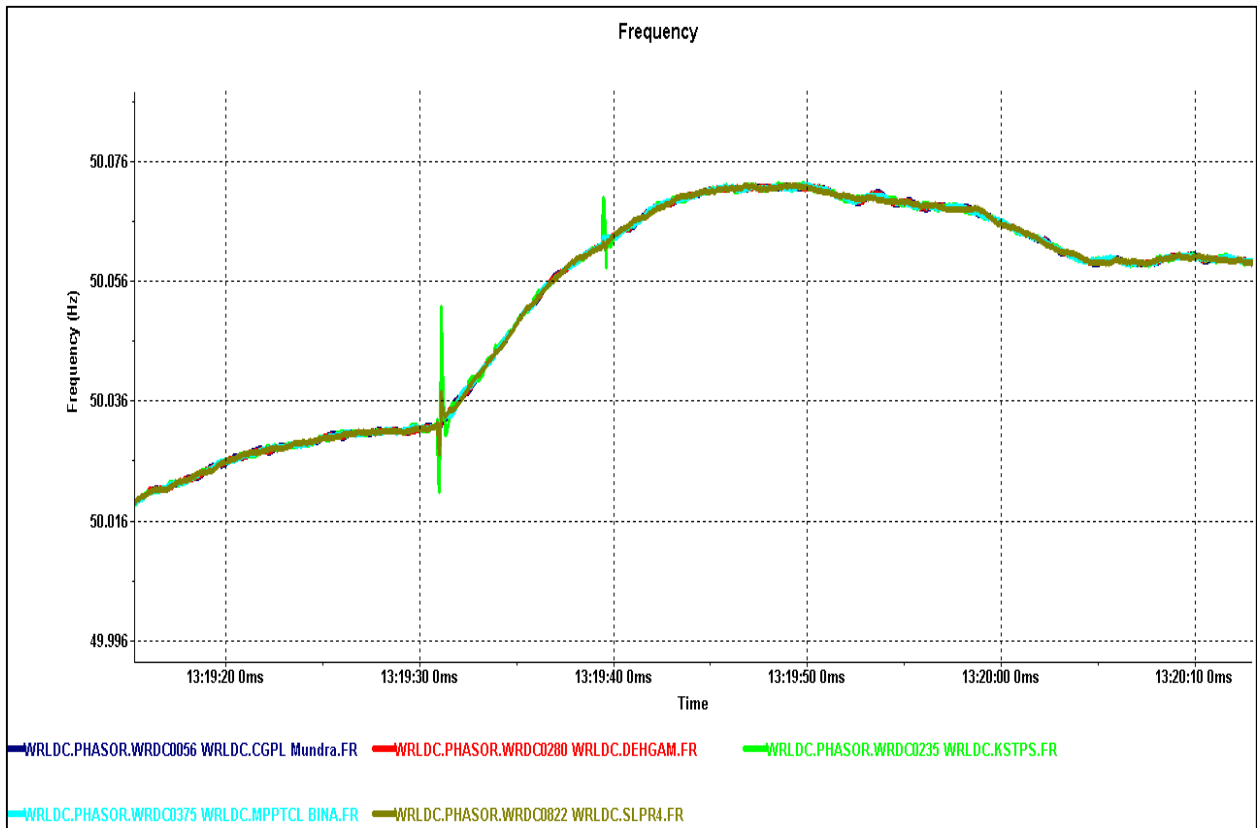


Figure 4 : Frequency observed from PMU during the event.

Restoration: Restoration started by isolating the faulty ICT 2 and charging of other 220 kV ICTs and 132 kV Lines. ICT 1 & 3 were restored by 15:15 Hrs and gradually other lines were restored.

6. Analysis: In absence of details from CSPTCL and Chhattisgarh SLDC, analysis of event could not be done.

7. Protection standard violation:

| Issues | Protection clause applicable | Agency |
|---|--|--|
| DR/EL not provided within 24 Hours | 1. IEGC 5.2 (r) 2. CEA grid Standard 15.3 | CSPTCL and Chhattisgarh SLDC (No DR/EL was provided for event) |
| Non-submission of Details for the tripping which is required for appropriate analysis for GD/GI | 1. IEGC 5.2 (r), 5.9.6.c (VI) 2. CEA grid Standard 15.3 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007-6. 4.d | CSPTCL and Chhattisgarh SLDC |
| Availability DR/ Event logger at Sub-station | 1. Indian Electricity Grid Code 4.6.3 2. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4 .D. 3. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1.7 | CSPTCL (DR/El is not available at the station as per the Protection Audit Report) |
| SCADA data Availability for the station | 1. IEGC 4.6.2 Data and Communication Facilities 2. IEGC 5.2.q | CSPTCL (SCADA data for sub-station was not updating during the event) |

8. Remarks:

- In view of above incident, CSPTCL and Chhattisgarh SLDC is advised to submit the detailed analysis report of the event along with relay/window indication, protection operation along with single line diagram indicating the event.
- Chhattisgarh SLDC may kindly nominate one executive as a nodal person for WRLDC whom can be contacted for collection of details for such event. The contact detail of nodal person should be sent to protectionwrldc@gmail.com.

Yours truly,

Abhimanyu Gartia
Dy. General Manager (MO-II & III & SL)

Grid Incidence at 400 kV Korba NTPC on 6th March 2016

Event Category: GI-2

Event Date and Time: 6th March 2016, 06:36 and 06:47 Hrs

Event Summary: Due to interruption of Colling tower and cooling water supply for the Korba Generation Stage 1 (Unit 1,2,3) and Stage 2 (Unit 4,5,6), these units tripped at 06:36 Hrs and 06:47 Hrs. This led to loss of generation 435 MW at 06:36 Hrs and 972 MW at 06:467 Hrs.

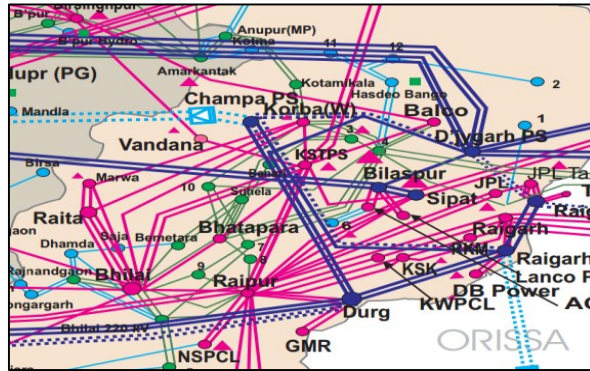


Figure 1 : Geographical Map

Event Analysis:

NTPC intimated that at 01:30 hrs, Tie Transformer-2 tripped on Differential protection at Korba power plant due to the failure of the synchronizing line PT. The 33 kV load of Tie-Transformer 2 was shifted to Tie-Transformer 1 and replacement activity of defective PT was initiated. After this Stage 1 and Stage 2 generation were reduced as the CT pumps not running due to system design.

At 06:35 hrs, Tie-Transformer 1 also tripped on differential protection leading to supply interruption of Colling tower/cooling water system for the stage 1 and stage 2 units. This has resulted in tripping of Stage 1 unit at 06:36 Hrs and Stage 2 units at 06:47 Hrs.

Generation loss and Frequency Change:

PMU plot of frequency shown in figure 2 provides that frequency drop during stage 1 tripping (Gen Loss: 435 MW) was 0.060 Hz i.e. from 49.967 Hz to 49.907 Hz. While in stage 2 gradual tripping of Units have occurred i.e. Unit 4 followed by unit 5 and 6 have tripped at short interval among them. Here frequency drop started from 49.961 Hz to 49.812 Hz i.e. by 0.159 Hz.

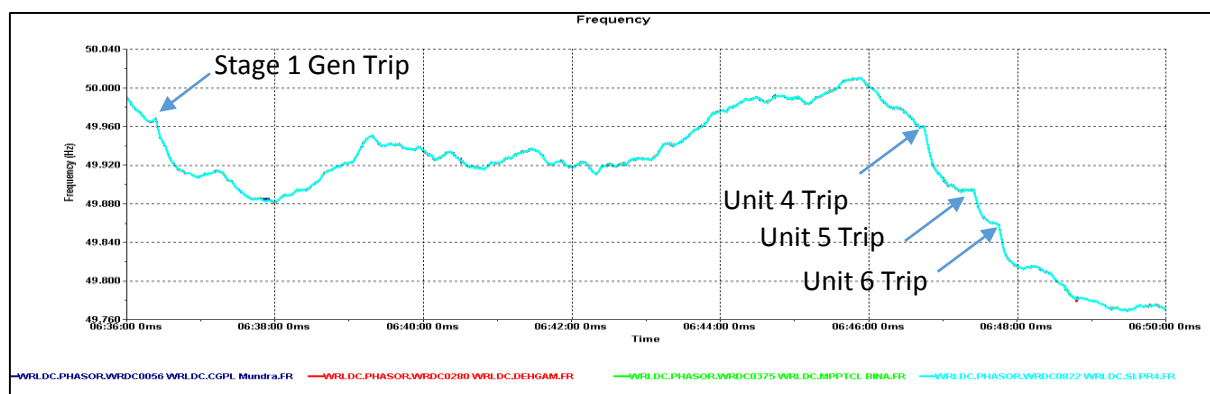


Figure 2 : Frequency of Indian Grid

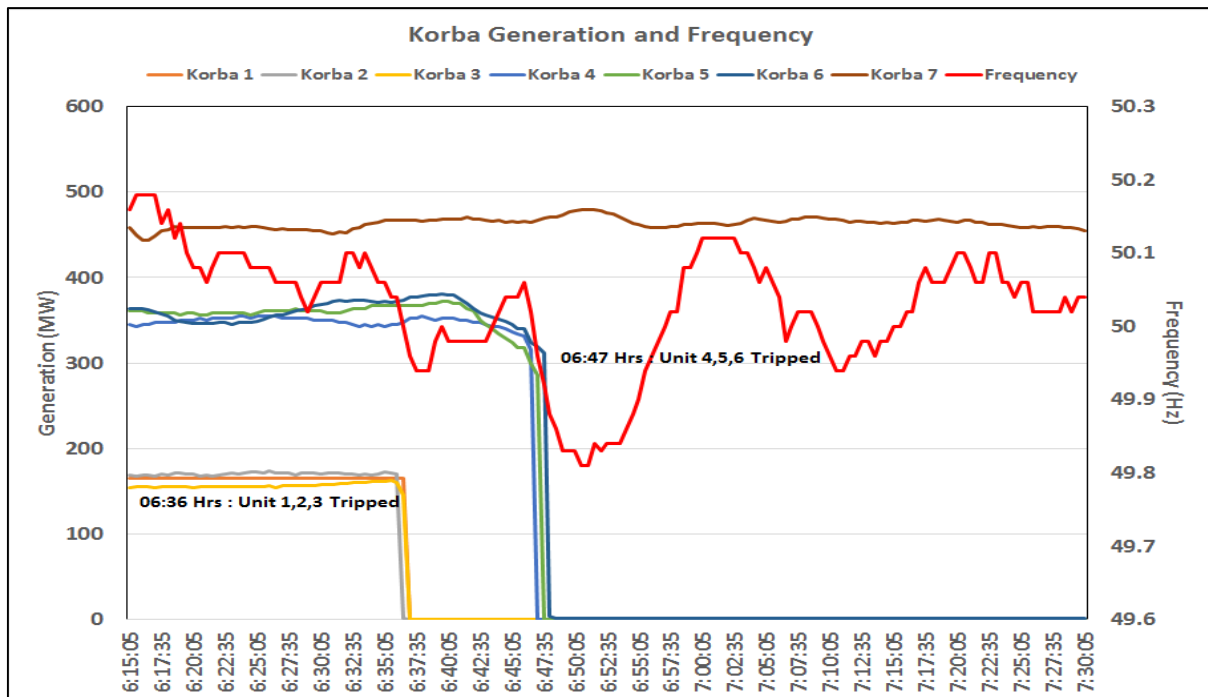


Figure 3 : Korba unit wise Generation and frequency from SCADA

Restoration:

After the event, restoration work was initiated. At 07:20 hrs, Tie Transformer-2 was charged and downside CW/CT system was normalized. After this units were restored as given below:

- Unit 6: Synchronized at 11:10 Hrs on 6th march 2016
- Unit 5: Synchronized at 11:36 Hrs on 6th march 2016
- Unit 1: Synchronized at 13:05 Hrs on 6th march 2016
- Unit 3: Synchronized at 14:32 Hrs on 6th march 2016
- Unit 4: Synchronized at 14:58 Hrs on 6th march 2016
- Unit 2: Synchronized at 15:26 Hrs on 7th march 2016

Remarks:

- This was a unique event as the loss of six unit due to Auxiliary supply issue has rarely observed in the western grid in recent Past. NTPC has indicated in their preliminary report that detailed analysis related to the tripping of Tie-Transformer 1 will be shared. However as of now no such details has been received. So NTPC is requested to kindly share the event in detail along with remedial action taken to prevent such kind of events in future.

Grid Incidence at Raipur Sub-station due to inclement weather on 18th March 2016

Event Category: GI-2

Event Date and Time: 18th Marc 2016, 16:23 Hrs

Event Summary: Due to inclement weather with rains and wind at Raipur Sub-station and its nearby area, 400 kV Raipur-Sipat 2, Raipur-Korba 3 and 400 kV Raipur-JPL D/C tripped on various indication.

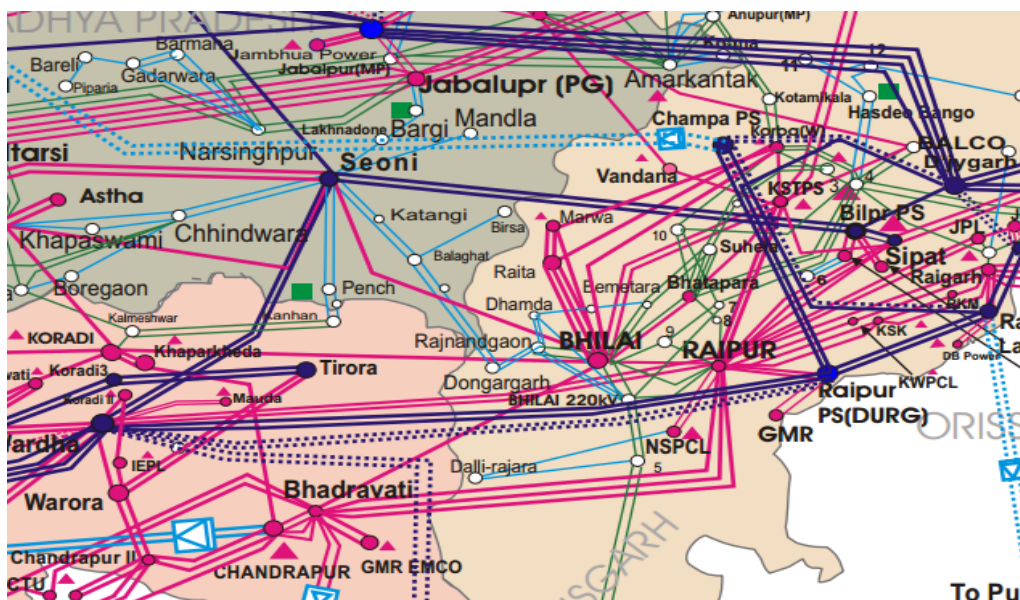


Figure 1 : Geographical Map

Event Analysis: Due to inclement weather in Raipur and nearby area, four lines tripped on faults. The details of relay indication along with restoration details is given in table 1. Among these three lines have tripped on fault in the line section while one line in the teed protection.

Table 1 : The sequence of tripping and restoration

| Name of the transmission element/ Unit | Time of Tripping (hh:mm:ss) | Relay indication End 1 | Relay Indication End 2 | Time of restoration (hh:mm) |
|--|-----------------------------|---|---|-----------------------------|
| 400 kV Raipur –JPL 1 | 16:23:27.447 | B phase to E/F, Breaker was under reclaim period of previous fault, Three phase trip, Fault current 7.48 kA | B phase to E/F, Fault current 1.54 kA, Zone 1 , Fault location 157 km. | 16:59 |
| 400 kV Raipur-JPL 2 | 16:23:28.886 | R phase to E/F, Fault current: 7.36 kA, A/R operated however fault persist and line tripped. | R phase to earth fault, Fault current: 1.65 kA, Zone 1, Fault location 202 km, A/R operated but line tripped due to persisting fault. | 18:49 |

| Name of the transmission element/ Unit | Time of Tripping (hh:mm:ss) | Relay indication End 1 | Relay Indication End 2 | Time of restoration (hh:mm) |
|--|-----------------------------|--|------------------------|-----------------------------|
| 400 kV Raipur-Korba 3 | 16:23:30.572 | Teed protection operated. | DT received. | 18:34 |
| 400 kV Raipur Sipat 2 | 16:23:31.822 | B phase to Earth fault, Fault current 10.3 kA, A/R operated but fault persisting, Three phase trip issued. | - | 19-03-16 15:05 |

Table 2 : SOE from WRLDC SCADA

| Element | Sub-station | Status | Time | ms |
|--------------------------|---------------------|---------|---------------------|-----|
| RAI4 JINDAL 1 CB | RSCC RAIPUR S 400 C | Faulty | 18-03-2016 16:23:23 | 312 |
| RAI4 JINDAL 1 CB | RSCC RAIPUR S 400 C | Open | 18-03-2016 16:23:23 | 317 |
| RAI4 JINDAL2-KSK -TIE CB | RSCC RAIPUR S 400 C | Faulty | 18-03-2016 16:23:23 | 528 |
| RAI4 RAI JINDAL 2 CB | RSCC RAIPUR S 400 C | Closed | 18-03-2016 16:23:23 | 530 |
| RAI4 JINDAL 1 TIE CB | RSCC RAIPUR S 400 C | Open | 18-03-2016 16:23:23 | 315 |
| RAI4 JINDAL 1 TIE CB | RSCC RAIPUR S 400 C | Transit | 18-03-2016 16:23:23 | 314 |
| RAI4 RAI JINDAL 2 CB | RSCC RAIPUR S 400 C | Closed | 18-03-2016 16:23:24 | 630 |
| RAI4 JINDAL2-KSK -TIE CB | RSCC RAIPUR S 400 C | Open | 18-03-2016 16:23:24 | 702 |
| RAI4 RAI JINDAL 2 CB | RSCC RAIPUR S 400 C | Open | 18-03-2016 16:23:24 | 703 |
| RAI4 RAI JINDAL 2 CB | RSCC RAIPUR S 400 C | Transit | 18-03-2016 16:23:24 | 700 |
| 400-RI-KOR4-CB | RSCC RAIPUR S 400 C | Transit | 18-03-2016 16:23:26 | 434 |
| RAI4 SIPAT 2 TIE CB | RSCC RAIPUR S 400 C | Faulty | 18-03-2016 16:23:26 | 403 |
| 400-RI-KOR4-CB | RSCC RAIPUR S 400 C | Open | 18-03-2016 16:23:26 | 437 |
| RAI4 SIPAT 2 CB | RSCC RAIPUR S 400 C | Faulty | 18-03-2016 16:23:26 | 396 |
| RAI4 SIPAT 2 CB | RSCC RAIPUR S 400 C | Closed | 18-03-2016 16:23:27 | 583 |
| RAI4 SIPAT 2 CB | RSCC RAIPUR S 400 C | Open | 18-03-2016 16:23:27 | 644 |
| RAI4 SIPAT 2 TIE CB | RSCC RAIPUR S 400 C | Open | 18-03-2016 16:23:27 | 677 |
| RAI4 SIPAT 2 CB | RSCC RAIPUR S 400 C | Faulty | 18-03-2016 16:23:27 | 639 |

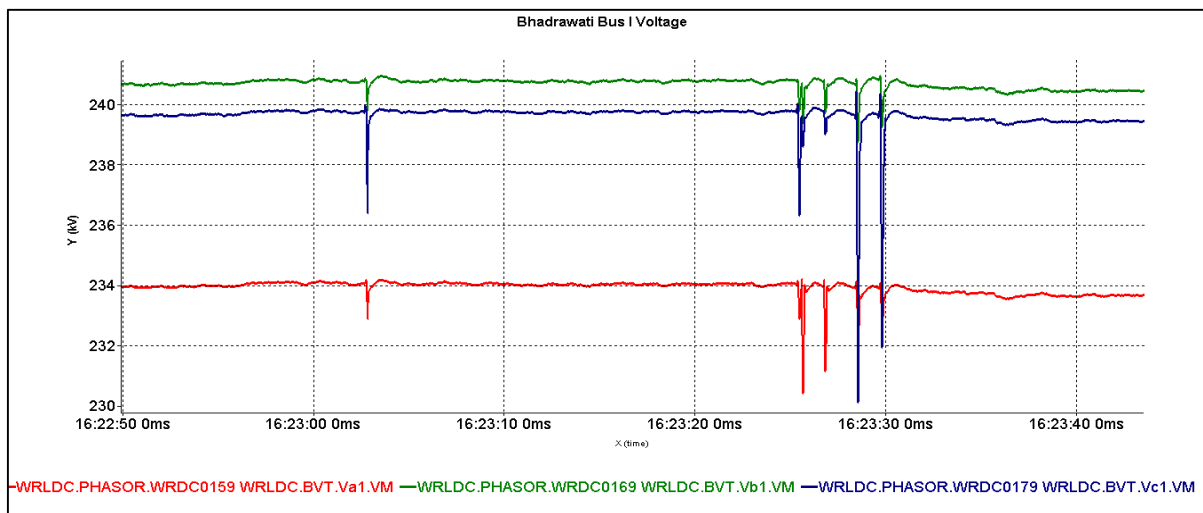


Figure 2 : Bhadrawati Bus voltage from PMU indicating various faults at Raipur.

Remarks:

- The tripping of 400 kV Raipur-Korba 3 on Teed protection at Korba end need to be checked properly by PGCIL. Weather any marks were observed in the section protected under teed need to be checked.
- There has been considerable delay in submission of DR and reports to WRLDC which is not desirable. In view of this, utilities are requested to kindly adhere to the regulations.

Annexure: DR from PGCIL and Report from JPL

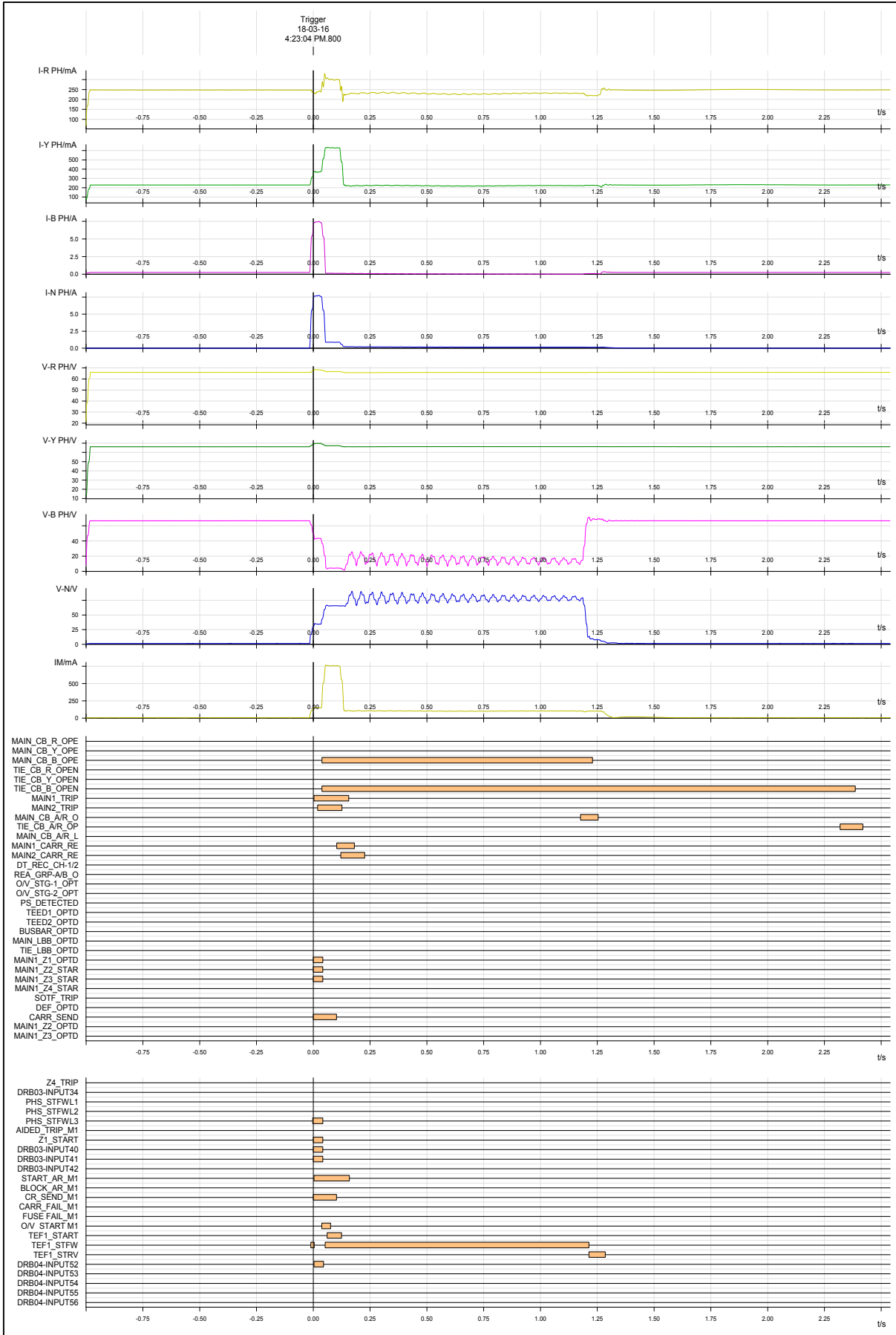


Figure: 400 kV Raipur-JPL 1 DR from Raipur end indicating successful A/R during first fault.

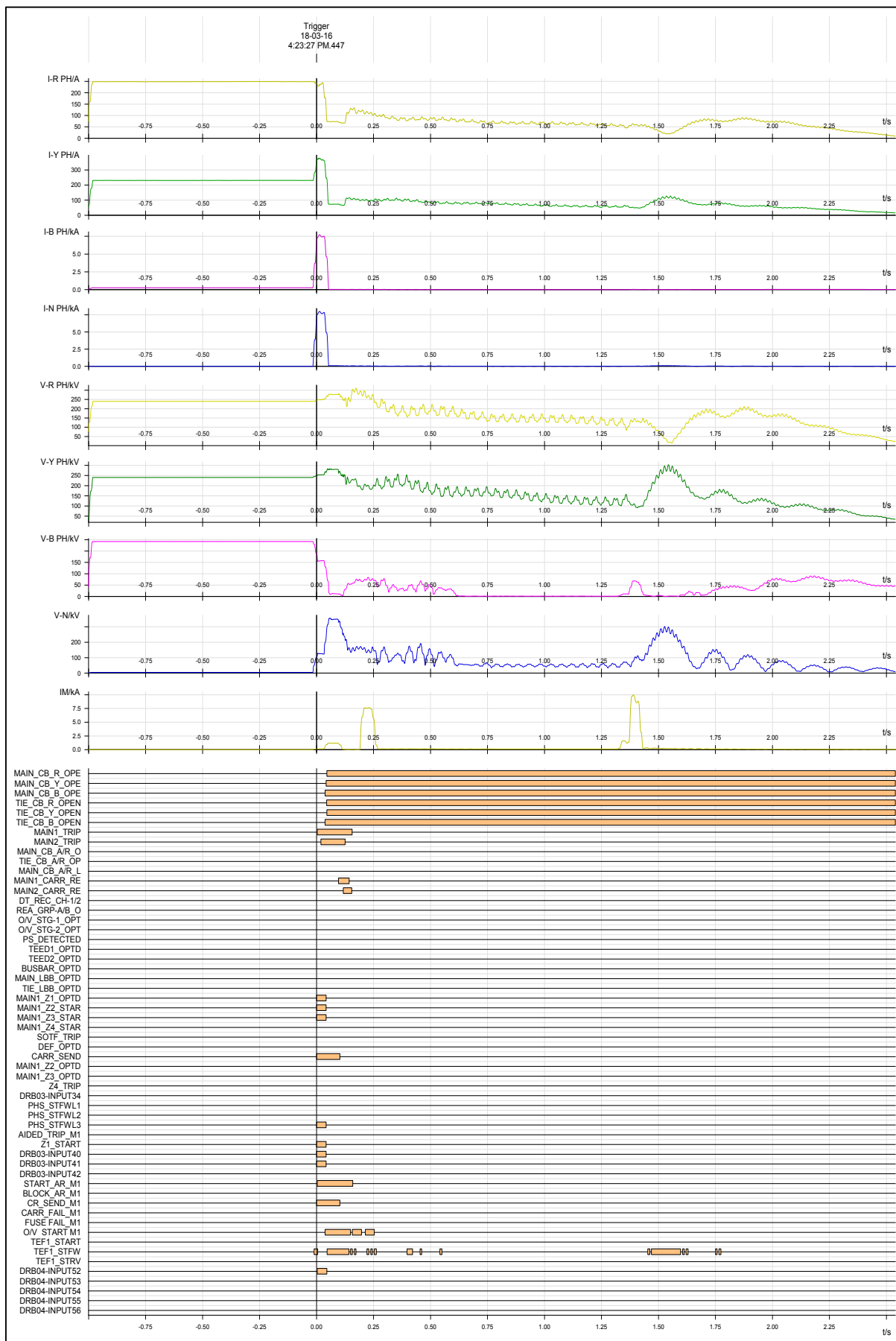


Figure: 400 kV Raipur-JPL 1 DR from Raipur end during second fault in breaker reclaim time causing its tripping from Raipur.

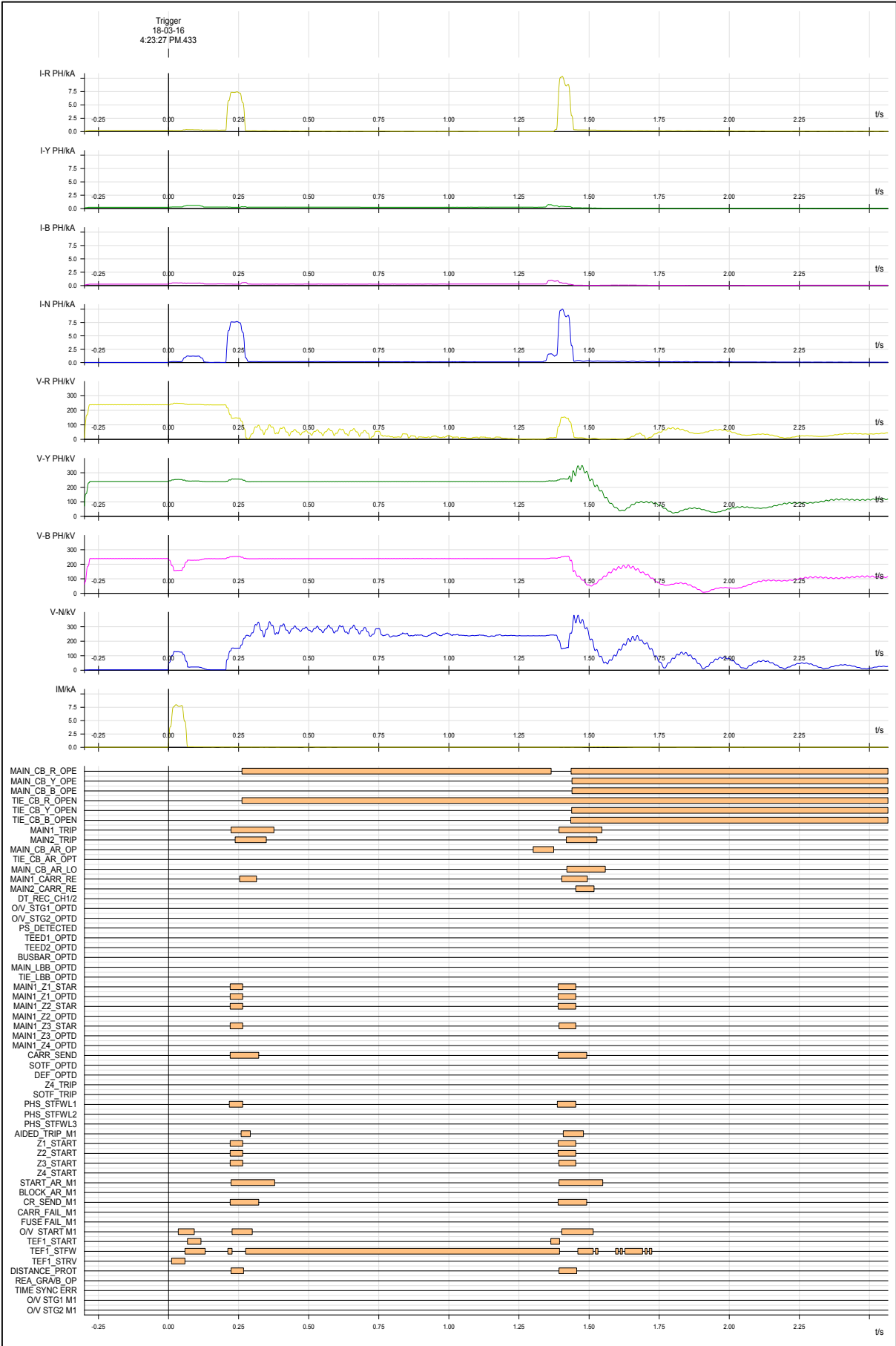


Figure: 400 kV Raipur-JPL 2 DR from Raipur end.

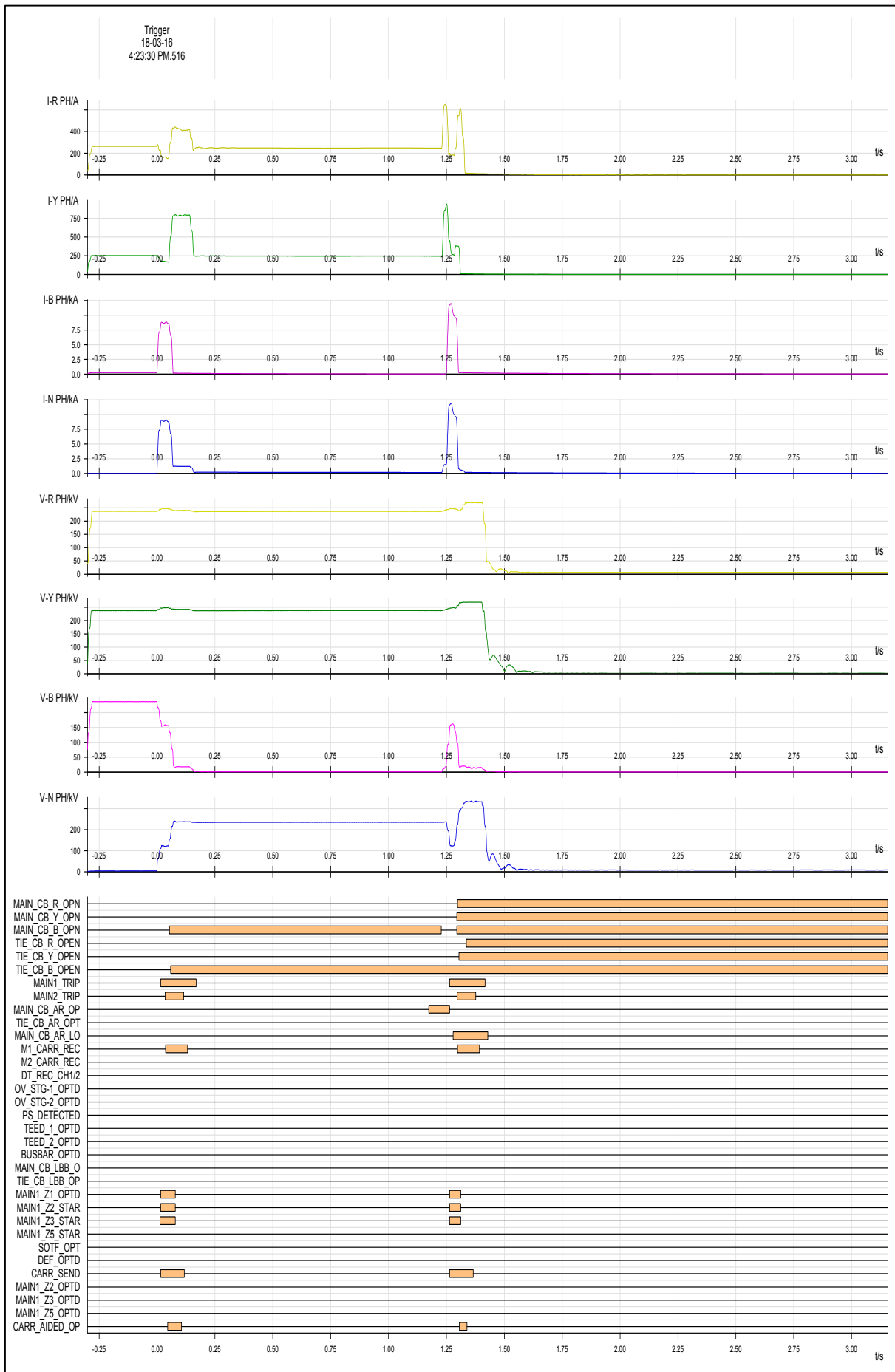


Figure: 400 kV Raipur-Sipat 2 DR from Raipur end.

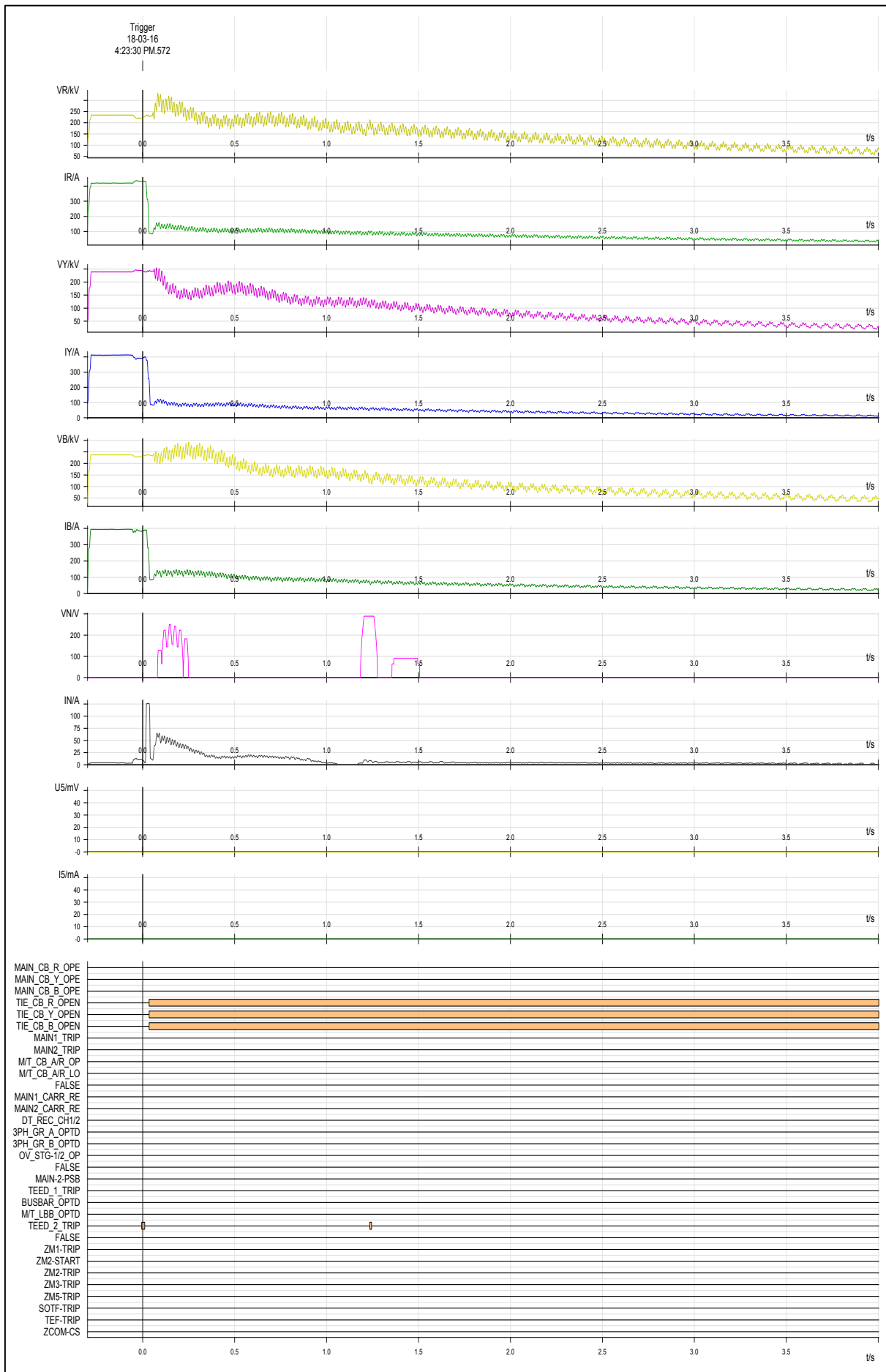


Figure: 400 kV Raipur-Korba 3 DR from Raipur end.

Report from JPL

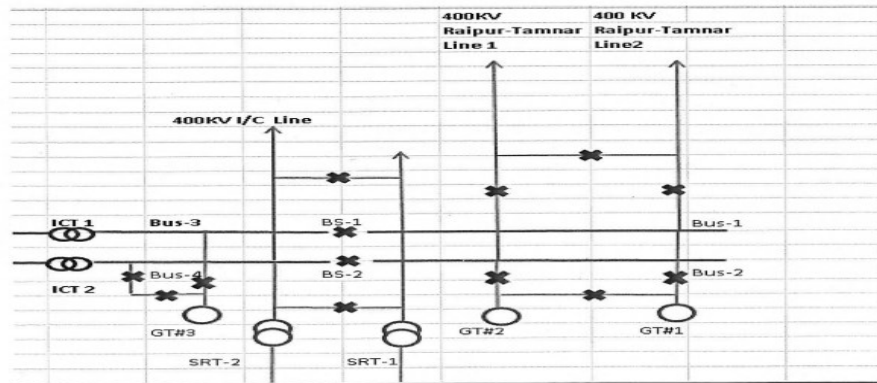
Detailed Report on occurrence at 400/220/33KV Substation at Jindal Power Ltd. Tamnar, Raigarh on 18/03/16

Event Summary: - At 16:23 hrs on dtd 18/03/16, 400KV Raipur-Tamnar line-1 tripped on Distance protection in zone-1 with earth fault in B phase at distance of 157 Km from Tamnar end. Auto-reclose operated but B phase fault occurred again resulting in 3-phase trip. At same time at 16:23 hrs 400KV Raipur-Tamnar line-2 tripped on Distance protection in zone-1 with earth fault in R-phase at distance of 203 Km from Tamnar end. Auto-reclose initiated but was blocked due to persisting fault resulting 3 phase trip operated. Heavy rain with thunder storm was observed at Raipur end whereas the weather was dry and clear at Tamnar end. Running units was not affected as load was transferred to 400KV Interconnection line between JPL Stage-I & Stage-II substation.

400KV Raipur-Tamnar line-1 & 2 was restored at 16:59 & 18:45 hrs respectively after getting charging code 03/2014 & 03/2019 from WRLDC, Mumbai.

Grid Frequency: 49.91 hz

Single Line Diagram



Power flow on Lines / ICT prior to the occurrence at 16:00 hrs :-

| Sl.No. | Name of Line/ICT | Power flow(in MW) |
|--------|----------------------------|-------------------|
| 1 | 400KV Interconnection Line | 362 |
| 2 | 400KV Raipur-Tamnar Line-1 | 161 |
| 3 | 400KV Raipur-Tamnar Line-2 | 162 |

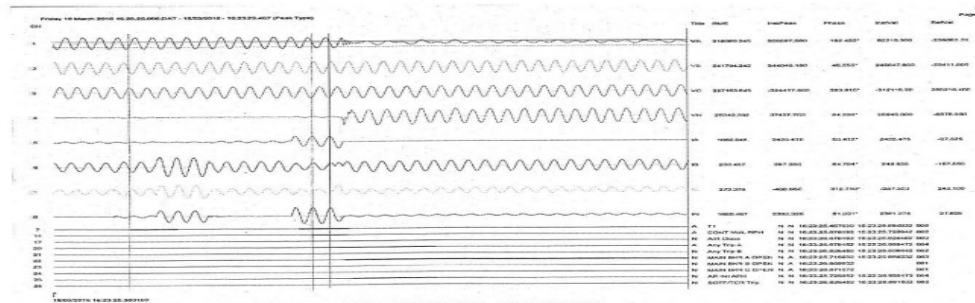
Generation Unit status Prior to the occurrence at 16:00 hrs:-

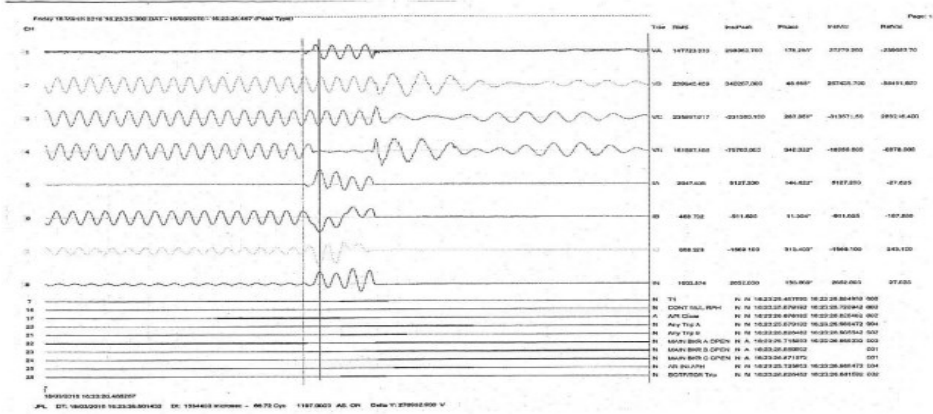
| Sl. No | Name of Generating Unit | Installed Capacity(MW) | Actual Generation in (MW) |
|--------|-------------------------|------------------------|---------------------------|
| 1 | Unit-1 | 250 | Not in service |
| 2 | Unit-2 | 250 | 236 |
| 3 | Unit-3 | 250 | 228 |
| 4 | Unit-4 | 250 | 212 |

The sequence of tripping and restoration.

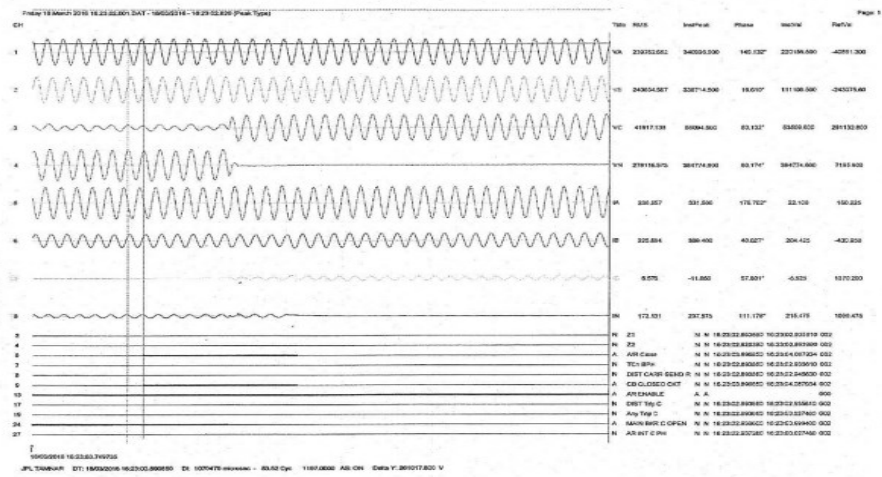
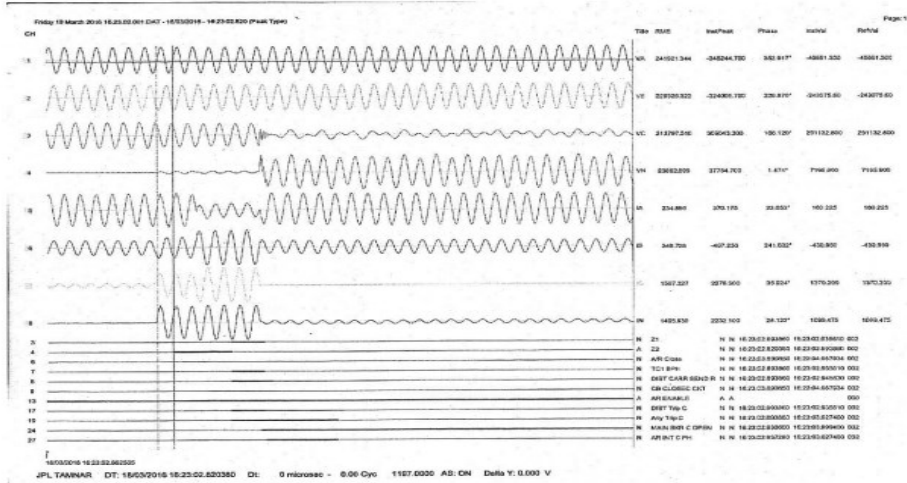
| Sl.No | Name of Lines / ICT | Time of tripping (hh:mm) | Relay Indication (JPL End) | Relay Indication (PCGIL Raipur End) | Time of Restoration(h h:mm) |
|-------|----------------------------|--------------------------|---|-------------------------------------|-----------------------------|
| 1 | 400KV Raipur-Tamnar Line-1 | 16:23 | Distance Protection operated Phase-B-N Phase, Zone -1, Distance-157.3 Km Fault Values IR =251A, IY =338A, IB =1540A VRN=241.6KV, VYN=229.1KV, VBN=215.9 KV. Auto-reclosed operated but B-phase fault occurred again line tripped. | Data awaited | 16:59 |
| 2 | 400KV Raipur-Tamnar Line-2 | 16:23 | Distance Protection operated Phase-R-Phase, Zone -1, Distance-202.3 Km Fault Values IR =1650A, IY =199.1A, IB =263.1A VRN=216.5KV, VYN=242KV, VBN=227 KV. Auto-reclose initiated but blocked due to persisting fault | Data awaited | 18:45 |

DR of 400KV Raipur-Tamnar Line-2





DR of 400KV Raipur-Tamnar Line- 1



Tripping of Units / ICT :-

Running units of JPL Stage-1 was not affected as load was transferred to 400KV Interconnection line between JPL Stage-I & Stage-II substation.

Restoration:-

400KV Raipur-Tamnar line-1 & 2 was restored at 16:59 & 18:45 hrs respectively after getting charging code 03/2014 & 03/2019 from WRLDC, Mumbai.

- The PMU plot shown in figure 2 from Jabalpur sub-station attached shows that fault initiated in Y phase (03:12:23.400) which got converted to a three phase fault. This fault has cleared in 320 ms.
- After 1.1 second, the fault reappeared in the system again as a three phase fault (03:12:23.800) and this time it cleared after 440 ms.
- **The delayed clearance of faults and the two faults presence in the system is indicative of two possibilities.**
 1. Issue with the Bus bar protection system operation and tripping of circuits from remote end along with A/R in any one of the circuit from the remote end which has seen this fault in its zone 1 after 1.1. Second.
 2. Or, Bus fault on Bus 1 and its delayed clearance followed by Bus fault on Bus 2 due to Fumes of the CT failure of Bus coupler and again its delayed clearance.

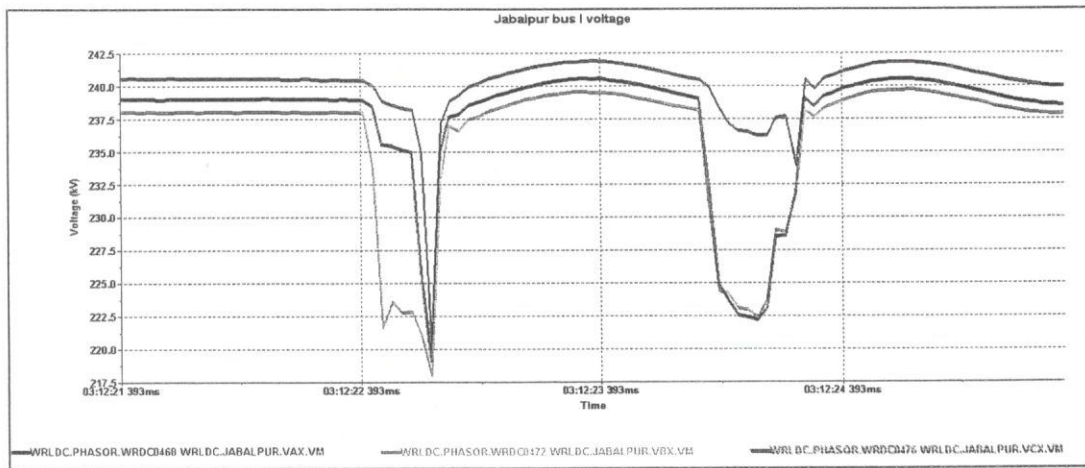


Figure 2 : Jabalpur voltage from PMU indicating two faults and their delayed clearances.

Load / Generation affected: Load of 50 MW and Generation of 306 MW got affected during the event.

Frequency Change : No significant change in frequency was observed.

Restoration: Restoration details are given in the flash report of the incident attached as annexure

6. Protection standard Issues:

| Issues | Protection clause applicable | Agency |
|---|---|---|
| DR/EL not provided within 24 Hours | 1. IEGC 5.2 (r) 2. CEA grid Standard 15.3 | MPPTCL(No Dr has been submitted) |
| Non-submission of Details for the tripping which is required for appropriate analysis for GD/GI | 1. IEGC 5.2 (r), 5.9.6.c (VI) 2. CEA grid Standard 15.3 3. CEA (Technical standards | MPPTCL/MPPGCL (No details on how lines and Units have tripped) |

| | | |
|---|---|---------------|
| | for connectivity to the Grid) Regulation, 2007-6. 4.d | |
| Fault clearance in more than 100 ms at 400 kV level and above and 160 ms at 220 kV levels | CEA Grid standard 2010 -3.e CEA Transmission Planning Criteria | MPPTCL |
| Incorrect operation/Misoperation of Protection system | 1. CEA Technical Standard for Construction of Electrical Plants and Electric Lines: 43.4 .A. 2. CEA (Technical standards for connectivity to the Grid) Regulation, 2007: Schedule Part 1. (6.1, 6.2, 6.3) | MPPTCL/MPPGCL |

7. Remarks:

- First the non-submission from MPPTCL/MPPGCL regarding the details related to this event is not desirable as it can be seen that nature of fault is three phase which is very severe followed by delayed clearance. **So, MPPTCL/MPPGCL may kindly submit the relevant details from their end on this tripping.**
- The reason for delayed fault clearance, failure of CT, amount of fault current need to be analysed properly By MPPTCL in order to ensure no such repetition occur in future.
- From the submission of MPPTCL regarding Group A and B deficiency observed in protection audit, it is observed that there are several issues pending at 220 kV Birsinghpur Pali sub-station and can affect the nearby Generating unit of Birsinghpur TPS directly as observed in the above case.

| Sl. No. | Name of Sub-Station identified for Protection Audit | LV Voltage | Name of Protection Audit Agency | Name of Sub-Station Audit Candidate | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies requiring procurement (Category-B) | | | Status |
|--|---|------------|---|-------------------------------------|---|---|---|----------------------|---|-----------------------|---------------------------------|--|
| | | | | | | Yes/No | Whether amount Yes/No | If not amount reason | Yes/No | Whether amount Yes/No | If not, expected date to closed | |
| 33 | BIRSINGHPUR Pali | 220 | Team of engineers from various entities coordinated by SLIC | 16/03/2015 | 1. Synchronizing facility is not available. | No | No | - | YES | NO | - | WIP issued & in process |
| | | | | | 2. Carrier protection panel at remote end is not available | YES | No | - | YES | NO | - | To be required. |
| | | | | | 3. Battery bank was commissioned on 05.06.2008. Battery charger was set off for about 2.5 hrs. Voltage dropped from 110 V to 105 V. Two cells are not working. Recommended for replacement. | No | No | - | YES | NO | - | In process |
| | | | | | 4. GPS is available but not enabled in relay. | Yes | YES | - | No | No | - | - |
| | | | | | 5. Trip bar protection kept off since 13.07.14. Needs to be taken into service. | YES | YES | - | No | No | - | - |
| | | | | | 6. DG not available. | YES | No | - | YES | NO | - | NO. If 1 hour needed for delivery of receipt will be coordinated in priority |
| | | | | | 7. LSP protection scheme of 132 KV not commissioned | YES | NO | - | No | No | - | Work in progress |
| | | | | | 8. Direct Trip scheme is not connected for 220KV feeders. | YES | NO | - | No | No | - | Work in progress |
| | | | | | 9. Broken conductor, sagging free lead. | Yes | YES | - | No | No | - | - |
| | | | | | 10. DTR trigger for fault current limiting should be configured | YES | NO | - | No | No | - | Work in progress |
| 11. SH-6 & air pressure status on the panel. | YES | No | - | YES | NO | - | alarm/notification factor is to be reworked | | | | | |

| Sl. No. | Name of Sub-Station Identifier for Protection Audit | KV Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | Deficiencies involving procurement (Category-B) | | Remark | |
|----------|---|------------|---|-------------------------------|---|---|-------------------------|---|--------|--------|-------------------------|
| | | | | | | Yes/No | Whether attended Yes/No | If not attended reason | Yes/No | | Whether attended Yes/No |
| Cont. 33 | BIRSINGHPUR PALI | 220 | Team of engineers from various entities constituted by SLDC | 16.03.2015 | 12. Relay fault recording menu should be provided to operating staff. | YES | YES | - | No | No | - |
| | | | | | 13. Auto reclose scheme is kept off. Recommended to be started after problem rectification. | YES | YES | - | No | No | - |
| | | | | | 14. DC voltage (110 V and 48 V) meters should be provided in control room. | No | No | - | YES | YES | - |
| | | | | | 15. 110V Battery charger voltage select switch is not working (both charger is not in working condition). | YES | YES | - | No | No | - |
| | | | | | 16. Annunciation board panel is not having any indication for auto-reclose operation. | YES | YES | - | No | No | - |
| | | | | | 17. Thermo-vision is out of order and regular readings are not taken on monthly basis. | YES | YES | - | No | No | - |
| | | | | | 18. Under-frequency relay supplies are given without fuse in between. | YES | YES | - | No | No | - |
| | | | | | 19. Under relay is not connected. | NO | NO | - | No | No | - |
| | | | | | 20. Group selection through phase interposition should be provided. | YES | NO | - | No | No | - |
| | | | | | 21. Over current REF relays settings should be directional which are non-directional at present. | YES | YES | - | No | No | - |
| | | | | | 22. Transformer tertiary circulating current CT is not connected to panel. | YES | YES | - | No | No | - |
| | | | | | 23. At 180 MVA transformer REF protection is not in service. | NO | NO | - | Yes | No | - |

This itself provides the need of accelerating the process of various activities for improving the reliability and protection at the 220/132 kV Birsinghpur Pali sub-station. **MPPTCL may kindly provide the present status along with the timeline for their completion.**

- The tripping of generating units which occurred during the incident need analysis as whether it was a correct operation or not. **MPPGCL may kindly present the reason for their units tripping at Birsinghpur TPS along with justifying the operation of the protection system.**
- **Madhya Pradesh SLDC is kindly requested to have an overview of this event and discuss the same in their internal OCC meeting to resolve the various issues observed.**

Yours truly,


Abhimanyu Gartia

Dy. General Manager (MO-II & III & SL)

Annexure: Flash Report from MP SLDC

Flash Report : SLDC/STU/Users/Transmission agency/Generators

Agency Name/Month-Year/GD or GI- Number

Name of Incident: *Y- ϕ CT Burst of 220KV Bus Coupler at 220KV S/S Birsinghpur Pali*

1. Date and Time: *28/02/16 at 03:12 Hrs*

2. Antecedent Conditions

I. Frequency of NEW Grid/SR Grid

| Event | Frequency | Time(hh:mm) |
|---------------|-----------|-------------|
| Pre incident | 49.94 Hz | 03:00 Hrs |
| Post Incident | 49.93 Hz | 03:26 Hrs |

II. Demand Met - 7004 MW

- State Generation - 1655 MW + 167 MW
- State Load - 7004 MW

3. Event Description: Event and Likely cause as reported by SLDC and as observed.
220KV Bus Coupler, Y- ϕ CT Burst at 220KV S/S Birsinghpur Pali resulting in tripping of all 220KV feeders emanating from 220KV S/S Birsinghpur from far end. Due to jerk @ SGTPS # 3 & 4 no units also tripped.


4. Lines/ICT/Units tripped and Restoration

| Lines/ICT/Unit Tripped | Load prior to fault | Tripping time | Restoration Time |
|---|---------------------|---------------|--|
| 1) 220KV Birsinghpur - SGTPS CKT-I, II, III, IV | 75, 70, 30, 23 | 03:12 Hrs. | I, III & IV 06:44, 06:50, 04:36 Hrs |
| 2) 220KV BRS-JBP-I | 83 | 03:12 | 03:52 Hrs. |
| 3) 220KV BRS-JBP-II | 83 | 03:12 | 04:11 Hrs |
| 4) SGTPS Unit # 3 | 154 MW | 03:12 | |
| 5) SGTPS Unit # 4 | 152 MW | 03:12 | 07:30 Hrs |
| 6) Rly Traction - I | 0 MW | 03:12 | 04:07 |
| 7) Rly Traction - II | 15 MW | 03:12 | 04:06 |

5. Areas Affected By Disturbance: *220KV S/S Birsinghpur Pali, 132KV S/S Umanaya, 220KV Railway Traction - I & II*

6. Load Loss: *approx 50 MW*

7. Generation Loss: *306 MW Due to tripping of SGTPS Unit # 3 & 4*


 SHIFT INCHARGE,
 State Load Despatch Centre

Annexure: Flash Report from MP SLDC

Flash Report : SLDC/STU/Users/Transmission agency/Generators

Agency Name/Month-Year/GD or GI- Number

Name of Incident: *Y-φ CT Burst of 220KV Bus Coupler at 220KV S/S Birsinghpur Pali*

1. Date and Time: *28/02/16 at 03:12 Hrs*

2. Antecedent Conditions

i. Frequency of NEW Grid/SR Grid

| Event | Frequency | Time(hh:mm) |
|---------------|-----------|-------------|
| Pre incident | 49.94 Hz | 03:00 Hrs |
| Post Incident | 49.93 Hz | 03:12 Hrs |

ii. Demand Met - 7009 MW

- State Generation - 1655 MW + 167 MW
- State Load - 7009 MW

3. Event Description: Event and Likely cause as reported by SLDC and as observed.
220KV Bus Coupler, Y-φ CT Burst at 220KV S/S Birsinghpur Pali resulting in tripping of all 220KV feeders emanating from 220KV S/S Birsinghpur from far end. Due to jerk @ SGTPS # 3 & 4 no units also tripped.

4. Lines/ICT/Units tripped and Restoration

| Lines/ICT/Unit Tripped | Load prior to fault | Tripping time | Restoration Time |
|--|---------------------|---------------|--|
| 1) 220KV Birsinghpur - SGTPS CKT-I, II, III, IV | 75, 70, 30, 23 | 03:12 Hrs. | I, III & IV 06:44, 06:50, 04:36 Hrs |
| 2) 220KV BRS-JBP-I | 83 | 03:12 | 03:52 Hrs. |
| 3) 220KV BRS-JBP-II | 83 | 03:12 | 04:11 Hrs |
| 4) SGTPS Unit # 3 | 154 MW | 03:12 | |
| 5) SGTPS Unit # 4 | 152 MW | 03:12 | 07:30 Hrs |
| 6) Rly Traction - I | 0 MW | 03:12 | 04:07 |
| 7) Rly Traction - II | 15 MW | 03:12 | 04:06 |

5. Areas Affected By Disturbance: *220KV S/S Birsinghpur Pali, 132KV S/S Umanagar, 220KV Railway Traction - I & II*

6. Load Loss: approx 50 MW

7. Generation Loss: 306 MW Due to tripping of SGTPS Unit # 3 & 4

[Signature]
 SHIFT INCHARGE,
 Regional Dispatch Centre

Annexure 3

| S.NO. | ELEMENT | TRIP | | RESTORED | | A/R STATUS | REASONS |
|-------|--------------------------------|------------|------------|------------|------------|------------|---|
| | | DATE | TIME | DATE | TIME | | |
| 1 | 400 KV SARNI-ITARSI FDR | 16.01.2016 | 12.00 Hrs. | 16.01.2016 | 12.45 Hrs. | Yes | Line Tripped due to ' CB Pole Descrepancy' protn. optd. |
| 2 | 400 KV SARNI-ITARSI FDR | 26.01.2016 | 21.05 Hrs. | 26.01.2016 | 21.40 Hrs. | Yes | DT received |
| 3 | 400 KV SARNI-ITARSI FDR | 27.01.2016 | 02.37 Hrs. | 27.01.2016 | 03.27 Hrs. | Yes | DT received |
| 4 | 400 KV SARNI - ASHTA FDR-I | 14.01.2016 | 16.31 Hrs | 14.01.2016 | 17.50 Hrs | Yes | Line Tripped due to malfunctioning of master trip relay (86-A lockout) on account of burning of its coil. |
| 5 | 400 KV BIRSINGHPUR-KATNI FDR-I | 19.01.2016 | 03.02 Hrs. | 19.01.2016 | 08.26 Hrs. | Yes | DT received. |
| 6 | 400 KV BIRSINGHPUR-KATNI FDR-I | 20.01.2016 | 01.58 Hrs. | 21.01.2016 | 09.03 Hrs. | Yes | DT received. |
| 7 | 400 KV BIRSINGHPUR-KATNI FDR-I | 21.01.2016 | 02.58 Hrs. | 30.01.2016 | 15.22 Hrs. | Yes | DT received. |
| 8 | 220 KV AMK-BIRSINGHPUR FDR-III | 06.01.2016 | 12.53 Hrs. | 06.01.2016 | 13.14 Hrs. | Yes | Line Tripped due to 'C-N' phase fault, Z-I optd. |
| 9 | 220 KV BIRSINGHPUR-PANAGAR FDR | 15.01.2016 | 05.50 Hrs. | 15.01.2016 | 06.45 Hrs. | | Line Tripped due to ' Directional E/F relay' optd. |
| 10 | 220 KV BIRSINGHPUR- REWA FDR | 18.01.2016 | 23.10 Hrs. | 24.01.2016 | 17.03 Hrs | | Line Tripped due to 'B' phase fault, Z-I optd. |
| 11 | 220 KV BIRSINGHPUR- REWA FDR | 28.01.2016 | 17.40 Hrs. | 29.01.2016 | 11.11 Hrs. | | Line Tripped due to 'B' phase fault, Z-I optd. |
| 12 | 220 KV TONS- SATNA FDR | 18.01.2016 | 21.15 Htrs | 19.01.2016 | 13.41 Htrs | | Line Tripped due to 'A-N' phase fault, Z-I optd. |
| 13 | 220 KV TONS- REWA FDR-I | 22.01.2016 | 13.50 Hrs | 22.01.2016 | 14.30 Hrs | | Line Tripped due to ' Earth fault' |
| 14 | 400 KV SARNI- ISP FDR | 29.02.2016 | 06.13 Hrs. | 29.02.2016 | 06.37 Hrs. | In service | Line Tripped due to 'R' phase fault, Z-1 optd. |
| 15 | 400 KV SARNI - ASHTA FDR-II | 18.02.2016 | 22.58 Hrs | 19.02.2016 | 01.14 Hrs | In service | Line Tripped due to ' tripping of Buchholz relay of reactor '. Line was charged isolating the reactor. |

| | | | | | | | |
|-----|---|------------|------------|------------|------------|------------|---|
| 16 | 400 KV SARNI - ASHTA FDR-II | 19.02.2016 | 13.54 Hrs | 19.02.2016 | 15.49 Hrs | In service | Line Tripped due to ' tripping of Reactor Buchholz relay'. 50 MVAR reactor was out of service at the time of tripping, on checking tripping contacts wiring of Buchholz relay was found shorted. Fault attended and Line was charged. |
| 17 | 220 KV AMK-JABALPUR FDR-II | 11.02.2016 | 03.29 Hrs | 11.02.2016 | 03.41 Hrs | In service | Line Tripped due to 'A' phase fault, Z-2 optd. |
| 18 | 220 KV AMK-PANAGAR FDR | 11.02.2016 | 12.02 Hrs | 11.02.2016 | 12.20 Hrs | In service | Line Tripped due to 'AB' phase fault, Z-2 optd. |
| 19 | 220 KV AMK-SIDHI FDR | 12.02.2016 | 22.12 Hrs | 12.02.2016 | 22.53 Hrs | In service | Line Tripped due to 'B-N' phase fault, Z-I optd. |
| 20 | 220 KV AMK-SIDHI FDR | 13.02.2016 | 00.23 Hrs | 13.02.2016 | 00.35 Hrs | In service | Line Tripped due to 'B-N' phase fault, Z-I optd. |
| 21 | 220 KV AMK-JABALPUR FDR-II | 14.02.2016 | 05.27 Hrs | 14.02.2016 | 05.37 Hrs | In service | Line Tripped due to 'A' phase fault, Z-I optd. |
| 22 | 220 KV BIRSINGHPUR- REWA FDR | 12.02.2016 | 22.15 Hrs. | 13.02.2016 | 00.38 Hrs | | Line Tripped due to O/C trip 'IA'. |
| 23 | 220 KV Interconnector I to IV tripped at SGTPS end due to failure of Bus Coupler CT of Birsinghpur Pali (MPPTCL) Sub station. | | | | | | |
| (a) | 220 KV BIRSINGHPUR- PALI I/C-I | 28.02.2016 | 03.12 Hrs. | 28.02.2016 | 06.48 Hrs. | | Line Tripped due to 'DPR, Z1, Z2 ', optd. |
| (b) | 220 KV BIRSINGHPUR- PALI I/C-II | 28.02.2016 | 03.12 Hrs. | 28.02.2016 | 11.46 Hrs. | | Line Tripped due to 'ARR,67 NX, E/F ' optd. |
| (c) | 220 KV BIRSINGHPUR- PALI I/C-III | 28.02.2016 | 03.12 Hrs. | 28.02.2016 | 06.50 Hrs. | | Line Tripped due to 'BC' phase fault, Z2', optd. |
| (d) | 220 KV BIRSINGHPUR- PALI I/C-IV | 28.02.2016 | 03.12 Hrs. | 28.02.2016 | 04.47 Hrs. | | Line Tripped due to 'BC' phase fault, Z2', optd. |

| | | | | | | | |
|----|--|------------|------------|------------|------------|------------|--|
| 24 | 400 KV BIRSINGHPUR- KATNI FDR-I | 13.03.2016 | 15.19 Hrs | 20.03.2016 | 10.50 Hrs | In service | DT received. |
| 25 | 220 KV AMK-PANAGAR FDR | 01.03.2016 | 11.38 Hrs. | 01.03.2016 | 11.55 Hrs. | In service | Line Tripped due to 'A-N' phase fault, Z-2 optd. |
| 26 | 220 KV AMK-BIRSINGHPUR FDR-II | 02.03.2016 | 14.24 Hrs. | 02.03.2016 | 14.36 Hrs. | In service | Line Tripped due to 86 L/O optd. |
| 27 | 220 KV AMK-PANAGAR FDR | 03.03.2016 | 14.43 Hrs. | 03.03.2016 | 19.12 Hrs. | In service | Line Tripped due to 'A-N' phase fault, Z-2 optd. |
| 28 | 220 KV AMK-SIDHI FDR | 06.03.2016 | 10.43 Hrs. | 06.03.2016 | 11.29 Hrs. | In service | Line Tripped due to 'A-N' phase fault, Z-1 optd. |
| 29 | 220 KV AMK-SIDHI FDR | 06.03.2016 | 12.55 Hrs. | 06.03.2016 | 13.08 Hrs. | In service | Line Tripped due to 'ABC' phase fault, Z-1, Z2 optd. |
| 30 | 220 KV AMK-BIRSINGHPUR FDR-II | 13.03.2016 | 14.27 Hrs. | 13.03.2016 | 14.53 Hrs. | In service | Line Tripped due to 'A-N' phase fault, Z-1 optd. |
| 31 | 220 KV AMK-PANAGAR FDR | 13.03.2016 | 14.27 Hrs. | 13.03.2016 | 14.51 Hrs. | In service | Line Tripped due to 'A-N' phase fault, Z-1 optd. |
| 32 | 220 KV AMK-JABALPUR FDR-II | 20.03.2016 | 13.55 Hrs. | 20.03.2016 | 14.06 Hrs. | In service | Line Tripped due to 'C-N' phase fault, Z-1 optd. |
| 33 | 220 KV AMK-JABALPUR FDR-I | 27.03.2016 | 14.10 Hrs. | 27.03.2016 | 14.28 Hrs. | In service | Line Tripped due to 'A-N' phase fault, Z-1 optd. |
| 34 | 220 KV BIRSINGHPUR-PANAGAR FDR | 03.03.2016 | 11.08 Hrs. | 03.03.2016 | 12.12 | | Line Tripped due to 'R-N' phase fault, Z-1 optd. |
| 35 | 220 KV BIRSINGHPUR- REWA FDR | 06.03.2016 | 10.30 Hrs. | 06.03.2016 | 11.16 | | Line Tripped due to 'A' phase fault, Z-1 optd. |
| 36 | 220 KV BIRSINGHPUR-PANAGAR FDR | 07.03.2016 | 21.45 Hrs. | 07.03.2016 | 22.12 | | Line Tripped due to 'B' phase fault, Z-1 optd. |
| 37 | 220 KV BIRSINGHPUR-PANAGAR FDR | 26.03.2016 | 14.29 Hrs. | 26.03.2016 | 14.51 | | Line Tripped due to 'R' phase fault, Z1 optd. |
| 38 | 220 KV SARNI Substation interconnector No. 1 | 06.03.2016 | 14.04 Hrs. | 06.03.2016 | 15.10 Hrs. | | Line Tripped due to Over current at 'B' phase. |

| | | | | | | | |
|-------|---|------------|------------|------------|------------|--|--|
| 39 | 220 KV Substation Interconnector 1 & 2 and 400 KV/220 KV SARNI - ICT(220 KV side) tripped at STPS Sarni end due to failure of ' Y' phase CT of SARNI - BETUL feeder at 220 KV (MPPTCL) Sub station Sarni. | | | | | | |
| (a) | 220 KV SARNI Substation interconnector No. 1 | 27.03.2016 | 11.28 Hrs. | 27.03.2016 | 12.32 Hrs. | | At 11.28 Hrs, in 220 KV S/S SARNI (MPPTCL) - Betul feeder Y phase CT burst and simultaneously Sarni-Substation interconnector No. 1& 2 tripped due to ' Y-N' phase fault and 400 KV/220 KV I.C.T. both side CB tripped on 220 KV side Y-phase Back Up O/C protection operated. |
| (b) | 220 KV SARNI Substation interconnector No. 2 | 27.03.2016 | 11.28 Hrs. | 27.03.2016 | 12.33 Hrs. | | -do- |
| (c) | 400 KV/220 KV SARNI - ICT | 27.03.2016 | 11.28 Hrs. | 27.03.2016 | 12.40 Hrs. | | -do- |
| 40 | 220 KV SARNI - ITARSI FDR No. 2 | 27.03.2016 | 12.22 Hrs. | 27.03.2016 | 13.23 Hrs. | | Line Tripped due Zone-I, PAT, PE optd. |
| 41 | 220 KV TONS- KOTAR FDR | 12.03.2016 | 12.20 Hrs. | 12.03.2016 | 13.10 Hrs. | | Line Tripped due to 'A-N' phase fault, Z1 optd. |

Tripping Detail for the CGPL system dtd 13/07/16

| Line Name | Tripping detail | Remarks |
|-----------------------------|--|---|
| 400kV Bhachau Versana#1 | At 20:29:11.406, Bus fault happened at Versana end due to flashover in Adani#1 Y Ph Bus#1 PG isolator Post Insulator. Line tripped from Versana end | |
| 400kV Bhachau Versana#2 | At 21:49:00.935, Bus fault happened at Versana end again due to charging of Adani#1 through Bus#2. However, this time also the same Bus Isolator Post Insulator was involved as through common AI Tube. Line tripped from Versana end. | |
| 400kV Bhachau Versana#1 | Line was out since 22:49 due to operation of Busbar Protection at Versana end on 20:29 | |
| | Charged from Bhachau end at 02:37:04.721 | Initially fault was in Y Ph then after around 100ms, Fault came in R & B Ph also Fault Current (kA) R Ph – 11.57, Y Ph – 12.3, B Ph – 11.82 |
| | Zone 2 picked up at 02:37:10.473 | Voltage got down to around 40kV |
| | Zone 2 optd at 02:37:10.824 at Bhachau end | Following flashovers found at Versana end of the line: - 1. Wave Trap – R & B Phase 2. BPI between LA & CVT – Y Phase |
| 400kV Mundra Bhachau#1 | <u>Bhachau end</u> - DT Receive at 02:37:10.819 <u>Mundra end</u> – Zone 2 optd | Rev Zone picked up at 02:37:10.485, Fault current (kA) R Ph – 3.42, Y Ph – 3.45, B Ph - 3.34 |
| 400kV Mundra Bhachau#2 | <u>Bhachau end</u> - Power Swing optd on 02:37:11.169 <u>Mundra end</u> – Carrier aided protection optd | |
| 400kV Bhachau Ranchodpura#1 | <u>Bhachau end</u> - Tripped on Over Voltage Stage 1 at 02:37:15.237 | |
| 400kV Bhachau Ranchdopura#2 | <u>Bhachau end</u> - Tripped on Over Voltage Stage 1 at 02:37:16.219 | |
| 400kV Essar Bhachau#1 | <u>Bhachau end</u> - Tripped on Over Voltage Stage 1 at 02:37:16.236 | |
| 400kV Essar Bhachau#2 | <u>Bhachau end</u> - Tripped on Over Voltage Stage 1 at 02:37:16.243 | |
| 400kV Mundra Jetpur#1 | <u>Jetpur end</u> - Tripped on DT receive at around 02:37 appears to be due to Power Swing at Mundra end | |
| 400kV Mundra Jetpur#2 | | |
| 400kV Mundra Limbdi | <u>Limbdi end</u> - Tripped on DT receive at around 02:37 appears to be due to Power Swing at Mundra end | |
| 400kV Mansar Limbdi | Tripped on DT receive at Limbdi around 02:37 | |

CGPL Disturbance Recorder Analysis

| Time | Element | Remarks |
|--------------|-----------------------|---|
| 02:37:10.454 | 400 kV CGPL Bhachau 1 | Y Phase to earth fault started in system |
| 02:37:10.479 | 400 kV CGPL Bhachau 1 | Zone 2/Zone 3 Start (IY=3 kA) |
| 02:37:10.532 | 400 kV CGPL Bhachau 1 | Fault appeared in R and B phase also (IR=3.31 kA, IY=3.41, IB=3.31 kA) : Three phase fault |
| 02:37:10.779 | 400 kV CGPL Bhachau 1 | Zone 2 Trip issued (300 ms for Zone 2) |
| 02:37:10.824 | 400 kV CGPL Bhachau 1 | Line Tripped |
| | | |
| 02:37:10.454 | 400 kV CGPL Bhachau 2 | Y Phase to earth fault started in system |
| 02:37:10.480 | 400 kV CGPL Bhachau 2 | Zone 2/Zone 3 Start (IY=3 kA) |
| 02:37:10.530 | 400 kV CGPL Bhachau 2 | Fault appeared in R and B phase also (IR=3.58kA, IY=3.38, IB=3.25 kA) : Three phase fault |
| 02:37:10.881 | 400 kV CGPL Bhachau 2 | Zone 2/ Zone 3 Reset. Voltage reduction starts in the phases however current remained same. No tripping in Zone 2 even after 400 ms. |
| 02:37:11.164 | 400 kV CGPL Bhachau 2 | Zone 2/Zone 3 Picked up (Power swing entered zone 1) |
| 02:37:11.174 | 400 kV CGPL Bhachau 2 | Trip command issued. |
| 02:37:11.219 | 400 kV CGPL Bhachau 2 | Line tripped |
| | | |
| 02:37:11.130 | 400 kV CGPL-Choronia | Zone 3 Picked up in power swing (Due to gradual voltage reduction with slow increase in current caused impedance to enter zone 3 setting) |
| 02:37:11.145 | 400 kV CGPL-Choronia | Zone 2 Picked up in power swing (Due to gradual voltage reduction with slow increase in current caused impedance to enter zone 3 setting) |
| 02:37:11.155 | 400 kV CGPL-Choronia | Zone 1 Picked up in power swing (Due to gradual voltage reduction with slow increase in current caused impedance to enter zone 3 setting). Trip command issued. |
| 02:37:11.155 | 400 kV CGPL-Choronia | Line Tripped. |
| | | |
| 02:37.11.151 | 400 kV CGPL-Mansar | Zone 2/3 picked up in power swing. Trip command issued. (Zone 1 also breached as observed in R-X plot). PSB trip in Zone 1 |
| 02:37.11.196 | 400 kV CGPL-Mansar | Line tripped |

| | | |
|--------------|----------------------|--|
| 02:37:11.150 | 400 kV CGPL-Jetpur 1 | Zone 3 pickup during Power swing (Gradual voltage drop) |
| 02:37:11.160 | 400 kV CGPL-Jetpur 1 | Zone 2 pickup during Power swing (Gradual voltage drop) |
| 02:37:11.165 | 400 kV CGPL-Jetpur 1 | Zone 1 pickup during Power swing (R-X plot) Trip command issued. |
| 02:37:11.203 | 400 kV CGPL-Jetpur 1 | Line tripped |
| 02:37:11.150 | 400 kV CGPL-Jetpur 2 | Zone 3 pickup during Power swing (Gradual voltage drop) |
| 02:37:11.160 | 400 kV CGPL-Jetpur 2 | Zone 2 pickup during Power swing (Gradual voltage drop) |
| 02:37:11.160 | 400 kV CGPL-Jetpur 2 | Zone 1 pickup during Power swing (R-X plot) Trip command issued. |
| 02:37:11.203 | 400 kV CGPL-Jetpur 2 | Line tripped |

Observation:

- Three phase fault on 400 kV Bhachau-Varsana 2 at Varsana end (initially Y phase to earth later in R-Y-B Fault)
- This fault was observed 400 kV CGPL-Bhachau 1 and 2 circuit in zone 2/3.
- After 300 ms, 400 kV CGPL-Bhachau 1 line tripped in zone 2 however parallel circuit did not.
- After 350 ms fault on Bhachau-Varsana 2 cleared from Varsana end.
- This caused voltage recovery however the current on the 400 kV CGPL-Bhachau 2 increased with circuit 1 tripping.
- However, voltage after initial recover started reducing gradually and reaching near to zero kV. DR plots shows that Phase to neutral voltage started reducing from 151 kV to 8.33 kV in 290 ms after fault clearance (**Whether power swing or some other phenomenon**). This reduction in voltage was accompanied by only a small change in current during the period. However, such lower voltage led to Locus Movement of

impedance seen by relay in Zone3 followed by zone 2 and finally in zone 1 in form of power swing causing line tripping.

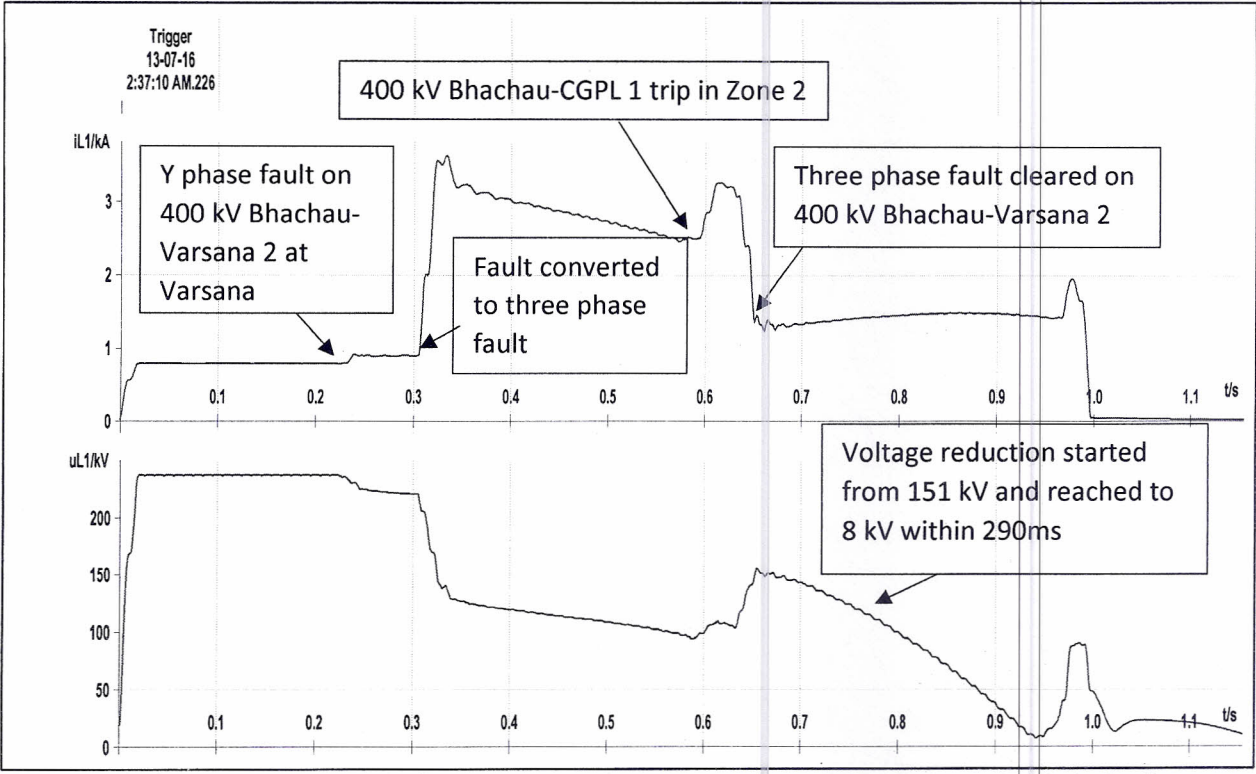
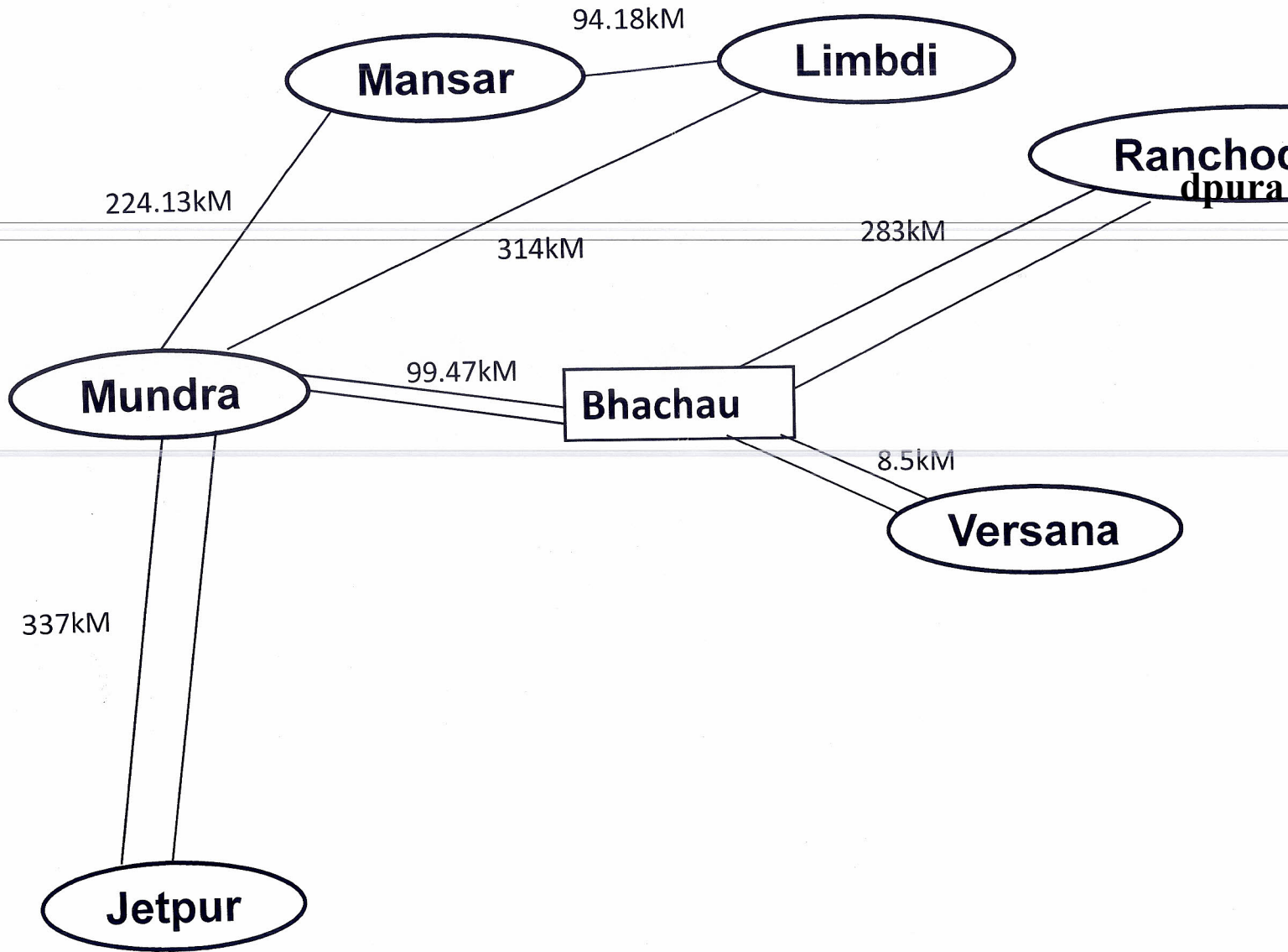


Fig: Voltage and current of R phase of 400 kV CGPL-Bhachau 2 which tripped at the last.



Connectivity Diagram of Bhachau S/s and CGPL system

Tripping Detail for the CGPL system dtd 13/07/16

| Line Name | End | Tripping Indication | Tripping Time | Restoration time | Remarks |
|-----------------------------|---------|---|---------------|------------------|--|
| 400kV Bhachau Versana#1 | Versana | Bus fault happened at Versana end due to flashover in Adani#1 Y Ph Bus#1 PG isolator Post Insulator. Line tripped from Versana end only | 20:29:11.406 | | |
| 400kV Bhachau Versana#2 | Versana | Bus fault happened at Versana end again due to charging of Adani#1 through Bus#2. However, this time also the same Bus Isolator Post Insulator was involved as through common AI Tube. Line tripped from Versana end. | 21:49:00.935 | 16:26 | |
| 400kV Bhachau Versana#1 | Bhachau | Line hand tripped at 22:49 from Bhachau end which was out since 20:29 due to operation of Busbar Protection at Versana end | 22:49:00.000 | | |
| | Bhachau | Charged from Bhachau end | 02:37:04.721 | | |
| | Bhachau | Zone 2 picked up | 02:37:10.473 | | First fault came in Y Ph then after around 100ms, Fault came in R & B Ph also. Fault Current (kA) R Ph – 11.57, Y Ph – 12.3, B Ph – 11.82, Voltage got down to around 40kV |
| | Bhachau | Zone 2 optd | 02:37:10.824 | | Following flashovers found at Versana end of the line: - 1. Wave Trap – R & B Phase 2. BPI between LA & CVT – Y Phase |
| 400kV Mundra Bhachau#1 | Mundra | Zone 2 start | 02:37:10.479 | 8:58 | Current in all 3 ph 3.5kA, Voltage in R & Y - 46kV and B - 140kV |
| | Mundra | Zone 2 optd | 02:37:10.779 | | Zone 2 delay at Mundra end was 300ms |
| | Bhachau | DT Receive | 02:37:10.819 | | Rev Zone picked up at 02:37:10.485, Fault current (kA) R Ph – 3.42, Y Ph – 3.45, B Ph - 3.34 Power Swing detected at 02:37:10.555 and got reset after 100ms |
| 400kV Mundra Bhachau#2 | Bhachau | Power Swing detected | 02:37:10.548 | 4:47 | Current in all 3 ph 3.5kA, Voltage in R & Y - 46kV and B - 140kV |
| | | Power Swing got reset | 02:37:10.658 | | Current in all 3 ph 3kA, Voltage in all 3 ph 46kV |
| | | Power Swing detected | 02:37:11.057 | | Current in all 3 ph 1.5kA, Voltage in all 3 ph 90kV |
| | | Power Swing optd in Zone 1 in 7SA522 | 02:37:11.169 | | Current in all 3 ph 1.5kA, Voltage in all 3 ph 35kV |
| | Mundra | Zone 2 Picked up | 02:37:10.482 | | |
| | | Zone 2 Reset | 02:37:10.881 | | |
| | | Power Swing Detected | 02:37:11.131 | | Current in all 3 ph 1.5kA, Voltage in all 3 ph 30kV |
| | | Power Swing optd in Zone 1 | 02:37:11.171 | | Current in all 3 ph 1.5kA, Voltage in all 3 ph 9.2kV |
| 400kV Bhachau Ranchodpura#1 | Bhachau | Tripped on Over Voltage Stage 1 | 02:37:15.237 | 3:11 | Ph – N Voltage around 325kV |
| 400kV Bhachau Ranchodpura#2 | Bhachau | Tripped on Over Voltage Stage 1 | 02:37:16.219 | 8:39 | |
| 400kV Mundra Jetpur#1 | Mundra | Power Swing detected | 02:37:11.129 | 19:50 | Current in all 3 ph 1.3kA, Voltage in all 3 ph 32kV |
| | | Z1 Optd and line tripped at Mundra end only and remain charged from Jetpur end | 02:37:11.165 | | Current in all 3 ph 1.5kA, Voltage in all 3 ph 9.2kV |
| | Jetpur | Tripped on DT receive. It appears to be due to operation of Over Voltage at Mundra end | 02:37:15.326 | | |
| 400kV Mundra Jetpur#2 | Mundra | Power Swing detected | 02:37:11.130 | 10:20 | Current in all 3 ph 1.3kA, Voltage in all 3 ph 32kV |
| | | Z1 Optd and line tripped at Mundra end only and remain charged from Jetpur end | 02:37:11.165 | | Current in all 3 ph 1.5kA, Voltage in all 3 ph 9kV |
| | Jetpur | Tripped on DT receive. It appears to be due to operation of Over Voltage at Mundra end | 02:37:16.323 | | |
| 400kV Mundra Limbdi | Mundra | Power Swing detected | 02:37:11.105 | 3:39 | Current in all 3 ph 2kA, Voltage in all 3 ph 51kV |
| | | Z1 Optd and line tripped at Mundra end | 02:37:11.155 | | Current in all 3 ph 2kA, Voltage in all 3 ph 12kV |
| | Limbdi | Power Swing detected, Carr aided trip optd | 02:37:11.189 | | Current in all 3 ph 2kA, Voltage in all 3 ph 166kV |
| | | Power Swing detected | 02:37:11.115 | | Current in all 3 ph 2kA, Voltage in all 3 ph 45kV |

Tripping Detail for the CGPL system dtd 13/07/16

| Line Name | End | Tripping Indication | Tripping Time | Restoration time | Remarks |
|-----------------------|---------|---|---------------|------------------|--|
| 400kV Mundra Mansar | Mundra | Carr aided prot. Optd at Mundra end only and remain charged from Mansar end | 02:37:11.178 | 9:35 | Current in all 3 ph 2kA, Voltage in all 3 ph 12kV |
| | Mansar | Line remain in service | 02:37:00.000 | | |
| 400kV Mansar Limbdi | Limbdi | Power Swing detected | 02:37:10.820 | 4:36 | Current in all 3 ph 1.5kA, Voltage in all 3 ph 200kV |
| | | Power Swing got reset. No tripping | 02:37:11.289 | | Current in all 3 ph 0.4kA, Voltage in all 3 ph 246kV |
| | | Tripped on DT receive but remain in service from Mansar end | 04:19:53.855 | | |
| | Mansar | Tripped from Mansar also | 04:19:55.943 | | |
| 400kV Essar Bhachau#1 | Bhachau | Tripped on Over Voltage Stage 1 | 02:37:16.236 | out of service | Voltage in all 3 ph 289kV (Ph-E) |
| 400kV Essar Bhachau#2 | Bhachau | Tripped on Over Voltage Stage 1 | 02:37:16.243 | out of service | Voltage in all 3 ph 289kV (Ph-E) |

Preliminary Analysis: -

Recently there have been incidences of tracking across Bus Post Insulators at Versana S/s due to which already 400kV Bus#1 & 2 got dead. This appears to be caused by saline environment in this rainy and misty weather.

Due to the same reason, during charging attempt of 400kV Bhachau Versana#1 from Bhachau end flashover took place at BPIs of Wave Trap (R&B), BPI between CVT & LA (Y) at Versana end. This has led to feeding of fault from Bhachau for 350ms as line was open from other end.

During the same time, Zone 2 of Mundra Bhachau#1 optd at Mundra end after 300ms delay. This tripping of Mundra Bhachau#1 could have been avoided, if Zone 2 time delay would have been 500ms (as Long Line is followed by very short line of 8kM at Mundra end). This undesired tripping caused Power Swing conditions in the system which resulted in tripping of all 400kV Lines connected at Mundra end on Power Swing entering in Zone 1. Also, DT has been received in Mundra Bhachau#1 at Bhachau end. It seems that DT send is configured for Zone 2 trippings at Mundra end. This is not a standard practice and needs to be corrected.

Further, from DR of Mundra end of Bhachau#2 line, it is observed that Zone 2 remain picked up for 400ms. However tripping was not processed, it seems that in this line Zone 2 time delay was more than 400ms due to which it has not tripped first and later tripped Power Swing.

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Amravati

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 1 | Paras | 220kV | 1. Dist relay of 220kV Akola-2 feeder is faulty. | -- | -- | -- | Yes | Yes | -- | The faulty relay is replaced |
| | | | 2. Relay configuration for AR features need to be corrected for 220kV Chikhali - I, 220kV Chikhali -II & 220kV Akola-I. | Yes | Yes | -- | -- | -- | -- | Relay configurn corrected and AR scheme commd. |
| 2 | Chikhali | 220kV | 1. Carrier protection & AR scheme for 220kV feeders not commissioned | -- | -- | -- | Yes | Yes | -- | SEL 321 relays replaced under retroftg scheme and AR Scheme commd. |
| | | | 2. Load trimming scheme for ICTs is needed. | Yes | Yes | -- | -- | -- | -- | Load trimming scheme commissioned. |
| 3 | Pusad | 220kV | Load trimming scheme for ICTs is needed. | Yes | Yes | -- | -- | -- | -- | LTS commissioned. |
| 4 | Malegaon | 132kV | Direction of EF relay of 132kV Risod feeder found wrong | Yes | Yes | -- | -- | -- | -- | Attended |
| 5 | Yavatmal | 220kV | Nil | -- | -- | -- | -- | -- | -- | -- |
| 6 | Dhamangaon | 220kV | 220/33kV TF-1 LV B/U relay-Open delta voltage not provided | Yes | Yes | -- | -- | -- | -- | Attended |
| 7 | Wani | 220kV | 1. Follwg relays found faulty: i)REC670 (one no) of 33kV fdr ii) REC670 (HV b/u) & RET670 (LV b/u) of TF-1. | -- | -- | -- | Yes | No | 31.03.2016 | Not complied. M/s ABB repretative required |
| | | | 2. Communication of 6 nos of 33kV bays with SCADA has failed. | -- | -- | -- | Yes | No | 31.03.2016 | |
| | | | 3. The SCADA is not working properly (DR computer does not communicate with SAS PC) | -- | -- | -- | Yes | No | 31.03.2016 | |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Amravati

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 8 | Patur | 132kV | Display unit of Bus bar relay ABB-REB 670 is faulty. | -- | -- | -- | Yes | No | 31.03.2016 | Not complied. Services of M/s ABB awaited. |
| 9 | Gorakshan Road akola | 132kV | Nil | -- | -- | -- | -- | -- | -- | -- |
| 10 | Akola MIDC | 132kV | Nil | -- | -- | -- | -- | -- | -- | -- |
| 11 | Anjangaon | 132kV | 132kV PT has single core and it is used for both protection and metering applications. | Yes | Yes | -- | -- | -- | -- | 132kV PT replaced with new PT set. |
| 12 | Karanja | 132kV | SCADA system not working properly, gets hanged frequently, Communication of Bus bar bay unit of TBC with SCADA has failed | -- | -- | -- | Yes | No | 31.06.2016 | Not complied. M/s ABB representative required |
| 13 | Washim | 132kV | Nil | -- | -- | -- | -- | -- | -- | -- |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone: Aurangabad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 1 | 220kV GIRWALI | 220kV | 1. Protected Line Lenth. 2. Brocken conductor function disabled. 3. SOTF selected for all zones. 4. PSB blocking zones selected as Z1, Z2, Z3, Z4. 5. 132kV bus-bar protection lct fail alarm & block settings were different. | YES | YES | -- | -- | -- | Completed | 1.Protected line length corrected & settings revised accordingly. 2 Brocken conductor function 3.SOTF selected for zone1&2. 4. PSB blocking applied to zones 2, 3&4. 5. lct fail alarm & block settings made same. |
| 2 | 220kV PARANDA | 220kV | 1. Time gradation of backup relays. 2. 132kV Bhairavnath feeder CT ratio revision. 3. Busbar protection's Isolator Fail Block protection found enabled | YES | YES | -- | -- | -- | Completed | 1.Time gradation of b/u relay recalculated & corrected. 2. 220kV B/B isolator fail block protection corrected. 3.132kV B/B protections isolator fail block protection corrected. |
| 3 | 220kV ICL PARLI | 220kV | I) ICL-PRL CKT CB Fault hence bypassed. II) ICL-HRL CKT distance relay faulty sent for repaired | YES | YES | -- | -- | -- | Completed | 1.ICL-PRL CKT CB TAKEN IN SERVICE. 2.220kV ICL-PARLI CKT DISTANCE RELAY COMMISSIONED on dtd.19.07.2014 |
| 4 | 132kV UJANI | 132kV | Line Lengths of 132kV Harangul and 132kV Omerga line are observed less than actual lengths. | YES | YES | -- | -- | -- | Completed | Line lengths corrected & settings revised. |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone: Aurangabad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 5 | 132kV LATUR KOYNA | 132kV | 1. Broken conductor function not configured. 2. Time gradation of backup relays 3. SOTF function found disable. | YES | YES | -- | -- | -- | Completed | 1. Broken conductor function is configured. 2. Time gradation of backup relays recalculated & corrected. 3. SOTF function enabled for zone 1, 2. |
| 6 | 132kV BEED | 132kV | Audit in Order | -- | -- | -- | -- | -- | -- | Audit in Order |
| 7 | 132kV OLD GCR PARLI | 132kV | 1) 132/33kv Transformer No.I HV backup Highset requires correction. 2)132kV/33kV TF.NO.II HV.backup Highset feature kept off, LV backup earthfault setting 30% | YES | YES | -- | -- | -- | Completed | Completed |
| 8 | Bhokardan | 220kV | Audit in Order | -- | -- | -- | -- | -- | -- | Audit in Order |
| 9 | Jalna MIDC | 132kV | (1) TF Electromechanical relay should be replaced by Numerical relay. | -- | -- | -- | YES | Partly Attended | Work in Progress | Requirement submitted to C.O. Vide L. No. SETCC/338 dt 21.12.2015 |
| | | | (2) Distance relay is Faulty of 132kV I/C -I from 220kV Jalna S/S. | -- | -- | -- | YES | NO | On Receipt of Relay | |
| 10 | Chitegaon | 220kV | 1. Fault Locator setting to b changed. 2. Zone II, Zone III settings to be revised | YES | YES | -- | -- | -- | Completed | 1. Fault Locator setting changed. 2. Zone II, Zone III settings revised |
| 11 | Paithan | 132kV | 1. Fault Locator setting to b changed. 2. Zone II, Zone III settings to be revised | YES | YES | -- | -- | -- | Completed | 1. Fault Locator setting changed. 2. Zone II, Zone III settings revised |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone: Aurangabad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 12 | 132kV Waluj | 132kV | 1. Fault Locator setting to be changed. 2. Zone II, Zone III settings to be revised | YES | YES | -- | -- | -- | Completed | 1. Fault Locator setting changed. 2. Zone II, Zone III settings revised |
| 13 | Chiklathana | 132kV | Audit found in order. | -- | -- | -- | -- | -- | -- | Audit found in order. |
| 14 | Harsool | 132kV | 132/33kV 50 MVA APEX make T/F Aux Protn for OSR and PRV was clubbed. | Yes | Yes | -- | -- | -- | Completed | A spare auxiliary protection relay has been provided to separate out OSR & PRV. |
| 15 | Soygaon | 132kV | Audit found in order. | -- | -- | -- | -- | -- | NA | Audit found in order. |
| 16 | Sawangi | 220kV | 220kV Sawangi - Padegaon Ckt Distance, B/up Protection, AR Problem. Siemens make relay needs replacement. | -- | -- | -- | YES | YES | Completed | Dist protection relay of this ckt has been replaced by Alstom make MiCOM P442. Now the A/R is taken in service. |
| | | | 220kV & 132kV Bus Bar Protection Scheme (ABB-REB-500)- Isolator status does not reach properly to this relay. | YES | YES | -- | -- | -- | Completed | At present isolator status of all 220kV & 132kV Isolators to Bus bar scheme is in order. |
| 17 | Shendra | 220kV | 220kV & 132kV Bus Bar Protection Scheme (ABB-REB-500)- Isolator status does not reach properly to this relay. | YES | YES | -- | -- | -- | Completed | At present isolator status of all 220kV & 132kV Isolators to Bus bar scheme is in order. |
| | | | 220kV Chitegaon - Shendra Ckt I & II, Distance, B/up Protection, AR Configuration Problem. | YES | YES | -- | -- | -- | Completed | Audit in Order |
| | | | 1. 132/11kV, 25MVA TF the REF Protection is wired out in HV B/up protection core. | -- | -- | -- | YES | NO | After Procurement. | After commissioning of Numerical Busbar and neutral CT |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone: Aurangabad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 18 | 220kV Waghala | 220kV | 2. Actual Distance Measurement for Waghala-Pusad line to be checked with Tourous. | YES | YES | -- | -- | -- | Completed | Carried out. |
| | | | 3. 200MVA BBL ICT-I &II Auxilary protection is wired out through operation of contactors. This scheme is to be revised for actual contacts & separate relays. | -- | -- | -- | YES | NO | After Procurement. | Auxillary relays to be procured |
| | | | 4. To rectify the frequent troubles due to cable cutting. The cable replacement for unarmoured to armoured is suggested. | -- | -- | -- | YES | NO | Partly carried out. | Cable requirement submitted to C.O. vide L. No. SETCC/342 dt 21.12.2015 |
| | | | 5. Line B/U electromechanical relays - 10 | -- | -- | -- | YES | NO | In Progress | Retrofitting work in progress |
| | | | 6. Differential relay electromechanical of EMCO ICT -3 | -- | -- | -- | YES | YES | Completed | completed |
| | | | 7. Numerical Busbar scheme required for 220kV, 132kV level | -- | -- | -- | YES | NO | After Procurement. | Requirement submitted to C.O. vide L. No. SETCC/342 dt 21.12.2015 |
| | | | 1.220kV Parbhani-Hingoli line length was wrongly feed. | YES | YES | -- | -- | -- | Completed | 220kV Parbhani-Hingoli line converted to Parbhani-Waghala Line. |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone: Aurangabad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|---|-------------------------|-------------------------|---|-------------------------|--|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 19 | 220kV Parbhani | 220kV | 2. As 33kV level is absent a, own Auxillary supply AC Source not available at 220kV Parbhani. 33kV & 11kV supply taken from Discom | -- | -- | -- | YES | NO | Will b completed on receipt of Station Transformer | Station Transformer Required |
| | | | 3. Line B/U electromechanical relays - 08 | -- | -- | -- | YES | NO | In Progress | Retrofitting work in progress |
| | | | 4. Differential relay ICT I & II electromechanical-02. | -- | -- | -- | YES | YES | Completed | Retrofitted |
| | | | 5. ICT HV and LV B/U electromechanical relay-04. | -- | -- | -- | YES | NO | On Receipt of Relay | Requirement submitted to C.O. Vide L. No. SETCC/338 dt 21.12.2015 |
| 20 | 220kV Hingoli | 220kV | 1. REF Protection of ICT-2 found off | YES | YES | -- | -- | -- | Completed | REF Protection of ICT-2 kept on |
| | | | 2. 220/33kV 25MVA TF differential relay is not in service (RET-670). | -- | -- | -- | YES | YES | Completed | Relay Repaired & Replaced. |
| 21 | 132kV Hingoli | 132kV | 1.132/33kV 50MVA TF-I & TF-II have Electromechanical Differential and HV - LV Back up relay | -- | -- | -- | YES | NO | In Progress | Differential Retrofitted. HV & LV Backup retrofitting work in progress. |
| 22 | 132kV Jangamwadi | 132kV | 1. 132/11kV 25MVA Emco TF auxiliary relays not reliable | -- | -- | -- | YES | NO | After Procurement. | Old Siemens make are in ckt but not reliable. Hence to be replaced. |
| | | | 2. 132/11kV 25MVA Apex TF Main PRV faulty | -- | -- | -- | YES | NO | PRV Procured | PRV to be installed |
| | | | 1) 132/33kV 50MVA TF-1 have Electromechanical Differential and HV -LV Backup relays. | -- | -- | -- | YES | NO | In Progress | Differential Retrofitted. HV & LV Backup retrofitting work in progress. |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone: Aurangabad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 23 | 132kV Kurunda | 132kV | 2) 132kV Kurunda-Hingoli line have Electromechanical back up relay | -- | -- | -- | YES | NO | In Progress | Retrofitting work in progress |
| | | | 3) 132kV Kurunda- Balapur have Electromechanical Line back up relay | -- | -- | -- | YES | NO | In Progress | Retrofitting work in progress |
| 24 | 132kV Elichpur | 132kV | 1. Teleprotection scheme is not in circuit. | -- | -- | -- | YES | YES | completed | |
| | | | 2. ABB make SCADA not in Service | -- | -- | -- | YES | NO | Pending | Matter taken up with M/S ABB |
| 25 | 132kV Kandhar | 132kV | 1.132kV Kandhar-Mukhed line settings was wrong | -- | -- | -- | YES | YES | Completed | 132kV Kandhar-Mukhed line settings revised. |
| | | | 2. Line B/U electromechanical relays-1 | -- | -- | -- | YES | NO | | Retrofitting work in progress. |
| | | | 3. Differential relay is eletromechanical-1 | -- | -- | -- | YES | YES | Completed | Retrofitted |
| 26 | 132kV Parbhani | 132kV | 1.Line B/U electromechanical relays - 03 | -- | -- | -- | YES | NO | | Retrofitting work in progress. |
| | | | 2.One 33kV OTI meter is faulty. | -- | -- | -- | YES | YES | NA | Meter Replaced. |
| 27 | 132kV Purna | 132kV | Audit in Order | -- | -- | -- | -- | -- | -- | Audit in Order |
| 28 | 132kV Gangakhed | 132kV | 1. 132/33kV BBL TF-I need REF relay | -- | -- | -- | YES | YES | Completed | Retrofitted |
| | | | 2. 132/33kV BBL TF-I have diff.relay electromechanical | -- | -- | -- | YES | YES | Completed | Retrofitted |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Karad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|---|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 1 | 220kV Ogalewadi | 220kV | A)Autoreclosure feature not operational on 220kV Karad-II line for Siemens SIPROTEC 7SA522 relay. | Yes | No | | - | - | - | During commissioning of 220kV Karad-Ogalewadi, Ckt.- I&II.Siemens engineer couldn't make A/R feature functional, Matter taken up with and yet to be complied by M/s Siemens. |
| | | | B) Siemens-SCADA, IED faulty | Yes | No | | - | - | - | M/s Siemens contacted to attend IED problem, Yet to be complied. |
| 2 | 220kV Malharpeth | 220kV | A)Autoreclosure feature not operational on 220kV Karad line for ABB make REL-670 type distance relay. | - | - | - | Yes | No | - | Replacement of > 25 yr. old breaker is to be done. EE(Testing) vide letter EE/TD/KRD/No.00791, dt. 24/09/2013 has taken up the issue with EE(O&M) Division-karad. |
| 3 | 220kV Lonand | 220kV | Electromechanical relay to be replaced by Numerical relay. | - | - | - | YES | No | Within 10 Days after receipt of relay, subject to outage. | Requirement is submitted to C.O. |
| 4 | 220kV Satara MIDC | 220kV | NONE | - | - | - | - | - | - | |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Karad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|---|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 5 | 220kV Wankusvade | 220kV | Equipments in detoriated condition. | - | - | - | YES | - | - | Autoreclosure scheme to be operationalise, so also various equipments in detoriated condition needs to be replaced in LE scheme |
| 6 | 220kV Kadegaon | 220kV | NONE | - | - | - | - | - | - | |
| 7 | 110kV Ashta | 220kV | NONE | - | - | - | - | - | - | |
| 8 | 110kV Vishrambag | 110kV | NONE | - | - | - | - | - | - | |
| 9 | 110kV Atit | 110kV | NONE | - | - | - | - | - | - | |
| 10 | 110kV Kundal | 110kV | NONE | - | - | - | - | - | - | |
| 11 | 110kV Tasgaon | 110kV | NONE | - | - | - | - | - | - | |
| 12 | 110kV K'Mahankal | 110kV | NONE | - | - | - | - | - | - | |
| 13 | 110kV Borgaon | 110kV | NONE | - | - | - | - | - | - | |
| 14 | 400kV Talandne | 400kV | Non working of Auto DR for 315 MVA ICT II | YES | No | | - | - | - | Matter taken up with M/S ALSTOM (In Process) |
| | | | DGA testing of ICT | YES | No | | - | - | - | DGA tender is in process by O & M circle office |
| | | | 220kV Ichalkaranji 2 LBB relay retrofitting | - | - | - | YES | No | within 10 days after receipt of relays, subject to outage | LBB relay requirement is submitted |
| | | | GPS synchronisation of Relays | YES | No | | - | - | - | Issue to be taken with manufacturer |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Karad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|--|---|-------------------------|---|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 14 | 400kV Karad | 400kV | 501 MVA (167 x 3) ICT 3 NDR relay retrofiting | - | - | - | YES | No | within 10 days after receipt of relays, subject to outage | Work is done |
| | | | DG set shall be made available for emergencies | - | - | - | YES | No | - | Requirment is submitted to C.O. |
| | | | DGA testing of ICT | YES | No | DGA tender is in process by O & M circle office | - | - | - | Work is done |
| 15 | 400kV Karad | | GPS synchronisation of Relays | YES | No | Issue to be taken with manufacturer | - | - | - | - |
| | | | 400kV Karad-Lonikand Line Autorecloser not in service. | YES | No | Relay configuration by ABB & old breaker replacement work to be carried out. | - | - | - | Work is done |
| | | | Nitrojen injectoin system for ICT -I is on Manual mode due to only one relay panel (CTR Make) | - | - | - | Yes | No | within 10 days after receipt of relays, subject to outage | Requirement of 400/220kV , 315MVA ICT-I relay panel already submitted to C.O Mumbai |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Karad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 16 | 220kV Mudshingi | 220kV | No | - | - | - | - | - | - | - |
| 17 | 220kV Mumewadi | 220kV | No | - | - | - | - | - | - | - |
| 18 | 220kV Halkarni | 220kV | No | - | - | - | - | - | - | - |
| 19 | 220kV Tilwani | 220kV | No | - | - | - | - | - | - | - |
| 20 | 220kV Lote | 220kV | No | - | - | - | - | - | - | - |
| 21 | 220kV Pawas | 220kV | No | - | - | - | - | - | - | - |
| 22 | 220kV Kharepatan | 220kV | No | - | - | - | - | - | - | - |
| 23 | 110kV Chambukhadi | 110kV | No | - | - | - | - | - | - | - |
| 24 | 110kV Shirolu | 110kV | No | - | - | - | - | - | - | - |
| 25 | 110kV Bapat Camp | 110kV | No | - | - | - | - | - | - | - |
| | | | Non working of Auto DR for 315 MVA ICT II | YES | No | | - | - | - | Matter taken up with M/S ALSTOM (In Process) |
| | | | GPS synchronisation of Relays | - | - | - | YES | No | - | GPS synchronisation is done for Main-I & Main-II |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Karad

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|---|-------------------------|-------------------------|---|-------------------------|---|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 26 | 400kV New koyna | | 315 MVA ICT I&II NDR relay retrofitting | - | - | - | YES | No | within 10 days after receipt of relays, subject to outage | Work is done. |
| | | | DG set shall be made available for emergencies | - | - | - | YES | No | - | Requirment is submitted to C.O. |
| | | | Stage IV Zone-1-Main-I, Main-II uniformity | YES | No | | - | - | - | Main-II old static relay replaced by Numerical the time of retrofitting |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| 1 | 220kV Wardha | 220kV | 1)Faulty Annunciators shall be replaced immediately | - | - | - | Yes | Yes | | Replaced on dt. 15.09.2014 |
| | | | 2) The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | Status of vermin proofing improved |
| | | | 3)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 4)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| 2 | 220kV Bhugaon | 220kV | 1) The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | Status of vermin proofing improved |
| | | | 2)Diagnostic Testing progress needs to be accelerated | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| 3 | 220kV Bhandara | 220kV | 1) The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 4) The old distance scheme of 132kV Kardha & 132kV Mauda feeder needs to be replaced. | - | - | - | Yes | Yes | - | |
| | | | 5)The existng Bus-bar scheme (ABB-RADSS) was lying idle for more than 10 years & maloperated in the past due to RQDA module problem or lack of vermin proofing. Hence needs to be replaced. | - | - | - | Yes | No | - | Existing scheme is in service. However, replacement by Numerical scheme is planned. PL. ref. ** |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|----------------------------------|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| 4 | 220kV Kaulewada | 220kV | 1)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 2) Shift Incharge & other operating staff are not conversant in testing relevant activities. | Yes | Yes | - | - | - | - | Training conducted on 07.02.2014 |
| | | | 3) Lack of proper vermin proofing & internal module problems, the existng bus-bar scheme (ALSTOM-PBLSB) maloperated in the past hence needs to be replaced. | - | - | - | Yes | No | - | Not Replaced |
| 5 | 220kV Umred | 220kV | 1) The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 98% |
| | | | 3) Oil Leakages observed in TF/ ICT | Yes | Yes | - | - | - | - | |
| 6 | 220kV Purti | 220kV | 1) The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 4)Level of distil water found very low in many cells of 48V Battery sets. | Yes | Yes | - | - | - | - | |
| 7 | 220kV Gadchiroli | 220kV | 1)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 2)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | 220kV | | 1)The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| 8 | 220kV Kalmeshwar | 220kV | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 4) Oil Leakages observed in TF/ ICT | Yes | Yes | - | - | - | - | |
| 9 | 220kV SICOM | 220kV | 1) The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | Status of vermin proofing improved |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 1)220/33kV, 25 MVA T/F -1 & 2 Test charged on dtd 30/01/2013 & 29/03/2013, since then the EHV O & M authorities have kept the equipment off. | Yes | Yes | - | - | - | - | T/F-I taken into service on dtd. 19.03.2014 & T/F-II on dtd. 26.03.2014 |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|---|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| 10 | 220kV Matardevi | 220kV | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | @ 50% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 4) RTU DC SCADA found out of service from dtd 31/7/2013. | Yes | Yes | | - | - | - | |
| 11 | 220kV MIDC Chandrapur | 220kV | 1) The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| 12 | 220kV Kanhan | 220kV | 1)The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 4) 48V DC battery set must be replaced immediately | - | - | - | Yes | Yes | - | The 48V DC battery set is reconditioned on 30.03.2014 |
| | | | 5) Oil Leakages observed in TF/ ICT | Yes | Yes | - | - | - | - | |
| | | | 6) Shift Incharge & other operating staff ar not conversant in testing relevant activities. | Yes | Yes | - | - | - | - | Training conducted on dtd. 05.03.2014 |
| | | | 1)Although the Constructional activities are going on, the status of vermin proofing need to be improved. | Yes | Yes | - | - | - | - | |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|---------------------------------|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| 13 | 400kV Warora | 400kV | 2) Status of Diagnostic Testing is almost Nil. | Yes | Yes | - | - | - | - | |
| | | | 3)220V DC Battery set Charging/ Discharging cycle & Battery efficiency test is to be carried out for ensuring the healthiness of battery sets. | Yes | Yes | - | - | - | - | |
| | | | 4) DC earth leakage must be attend immediately | Yes | Yes | - | - | - | - | |
| 14 | 220kV Virur | 220kV | 1)Poor status of vermin proofing wherein, CT MBs are found rusted & broken condition | Yes | No | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 4) Oil Leakages observed in TF/ ICT | Yes | Yes | - | - | - | - | |
| | | | 5) Distance scheme of 220kV Virur Gadchandur line 1 performed inconsistently in the recent past, hence for the moment it has kept with reduced Zone 2 timing of150msec. | | - | - | Yes | Yes | | |
| 15 | 220kV Gadchandur | 220kV | 1)The status of vermin proofing shall be improved | Yes | Yes | | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out. | Yes | Yes | - | - | - | - | |
| | | | 4)It is observed from previous record that Battery efficiency test is carried out on 9/4/2012 wherein the efficiency found to be 50%. | - | - | - | Yes | Yes | - | |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|---------------------------------|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| | | | 5) Oil Leakages observed in TF/ ICT. | Yes | No | - | - | - | - | |
| | | | 6)Most of the Kiosk(CT, PT , MB) are found grounded. | - | - | - | Yes | No | - | |
| 16 | 220kV Hinganghat | 220kV | 1)The status of vermin proofing shall be improved | Yes | Yes | - | - | - | - | |
| | | | 2) Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 4) The annunciator of 220kV TSS-I & Warora are out of service which need to be replaced immediately. | - | - | - | Yes | Yes | | Replaced on dt. 09.08.2013 |
| | | | 1)The status of vermin proofing shall be improved. | Yes | Yes | | - | - | - | |
| | | | 2)The equipments having abnormal tan delta values shall be replaced. | Yes | No | Will be replaced soon. | - | - | - | |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| 17 | 220kV Ambazari | 220kV | 4) The cell no:- 6 of 220V DC set no:-1 (efficiency:- 60%) found defective (Sp. Gr.:- 1140) also cell no:-42 & 102 are bypassed-need to be replaced. | - | - | - | Yes | No | - | The requirement is pending with EE, EHV (O&M) Dn, Nagpur |
| | | | 5) 48V DC set no:-1 efficiency observed as 60%. | - | - | - | Yes | Yes | - | |
| | | | 6)The existng Bus-bar scheme (ABB-RADSS) was lying idle for more than 10 years & maloperated in the past due to RQDA module problem or lack of vermin proofing. Hence needs to be replaced. | - | - | - | Yes | No | - | |
| 18 | 220kV Warora | 220kV | 1)The status of vermin proofing shall be improved | Yes | Yes | - | - | - | - | |
| | | | 2) Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out | Yes | Yes | - | - | - | - | |
| | | | 4) The annunciator of 220kV Chandrapur-I feeder is faulty which needs to be replaced immediately. | - | - | - | Yes | Yes | - | Replaced on dt. 12.08.2014 |
| | | | 5) The Differential relay of 220/33kV 50MVA T/F-II shall be replaced | - | - | - | Yes | Yes | - | Replaced on dt. 16.09.2013 |
| 19 | 400kV Chandrapur GCR | 400kV | 1)Capacitance & Tan Delta measurement of CC's & CVT's available at 400kV Chandrapur S/s not carried out so far. | Yes | Yes | - | - | - | - | |
| | | | 2) Relay Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | |
| | | | 3) Battery 220V Set 1 Cell no.36 is in poor condition & need to be replaced. | - | - | - | Yes | No | - | Not Replaced |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| | | | 4) The NDR voltage shall be monitored at regular intervals. | Yes | Yes | - | - | - | - | |
| 20 | 400kV Khaperkheda | 400kV | 1)The status of vermin proofing shall be improved | Yes | Yes | - | - | - | - | |
| | | | 2) The time synchronization, GPS receiver display problem, DR monitor problem shall be resolved by concerned Engineer. | Yes | Yes | - | - | - | - | |
| | | | 4)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out. The CELL no:-5 of 220V DC set no:-1 found weak. (Sp. Gr. 1110) needs to be replaced. | - | - | - | Yes | Yes | - | |
| | | | 5) Battery wooden stand found broken, needs to be repaired. | - | - | - | Yes | Yes | - | |
| | | | 6) The NDR relay shall be replaced | - | - | - | Yes | Yes | - | |
| | | | | | | | | | | |
| 21 | 220kV Khaperkheda | 220kV | 1)The status of vermin proofing shall be improved | Yes | Yes | - | - | - | - | |
| | | | 2)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out. The CELL no:-15 of 48V DC set found bypassed needs to be replaced. | - | - | - | Yes | Yes | - | |
| | | | 3)The existing Bus-bar scheme (ABB-RADSS) was lying idle for more than 10 years & maloperated in the past due to RQDA module problem or lack of vermin proofing. Hence needs to be replaced. | - | - | - | Yes | No | - | Existing scheme is in service. However, replacement by Numerical scheme is planned. Pl. ref. ** |
| | | | 1)The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone:-Nagpur

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|------------------------------------|-------------------------|-------------------------|------------------------|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected | | | Deficiencies involving | | | Present Status as on 31/12/2015 |
| | | | | Yes/ No | Whether attended Yes/No | If not attended, reason | Yes/ No | Whether attended Yes/No | If no, expected date to attend | |
| 22 | 220kV Butibori-I | 220kV | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out. | Yes | Yes | - | - | - | - | |
| | | | 4)The existing Bus-bar scheme (ABB-RADSS) was lying idle for more than 10 years & maloperated in the past due to RQDA module problem or lack of vermin proofing. Hence needs to be replaced. | - | - | - | Yes | No | - | Existing scheme is in service. However, replacement by Numerical scheme is planned. Pl. ref. ** |
| 23 | 400kV Koradi | 400kV | 1)The status of vermin proofing shall be improved | Yes | Yes | | - | - | - | |
| | | | 2) Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out for the current year. | Yes | Yes | - | - | - | - | |
| | | | 4) The NDR relay shall be replaced | - | | - | Yes | Yes | | |
| 24 | 220kV Abhijeet | 220kV | 1)The status of vermin proofing shall be improved. | Yes | Yes | - | - | - | - | |
| | | | 2)Diagnostic Testing progress needs to be accelerated. | Yes | Yes | - | - | - | - | 100% |
| | | | 3)To ascertain the healthiness of 220V DC Battery set Charging/ Discharging cycle & Battery efficiency test shall be carried out. | Yes | Yes | - | - | - | - | |

Note: ** Tender has been finalized for procurement of 76 Nos. of Busbar protection schemes at various EHV substations in MSETCL. Drawing approved. Busbar Pannels will be supplied shortly.

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : PUNE

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---------------------------------|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 1 | 400kV Chakan | 400kV | 1) 400kV Bus Bar relay ER make CSC 150 firmware upgradation work, regarding blocking of Bus Bar in intermediate condition while transfer operation. 2) 220kV Bus Bar relay ER make CSC 150 firmware upgradation work, regarding blocking of Bus Bar in intermediate condition while transfer operation. | Yes | Yes | | | | | Attended by M/S ERL |
| 2 | 400kV Jejuri | 400kV | 1) A/R of 400kV & 220kV lines taken in service. 2) NDR trip should be extended through derived open delta. 3) 400kV line VT supervision Delta setting attended. 4) LA Earth pit s are not connected to earth mesh | Yes | Yes | | | | | |
| | 400kV Lonikand I | 400kV | 220kV Kathapur line VT Supervision problem | Yes | Yes | | | | | |
| 3 | 400kV Lamboti | 400kV | 1) NDR Relay for ICT I replaced by Numerical Relay | | | | Y | Y | | |
| | | | 2) LBB setting revised to 0.8A & 0.2Sec | Yes | Yes | | | | | |
| 4 | 400kV Lonikand II | 400kV | Forcebly ON Commamd for isolator ON /OFF operation disabled | Yes | Yes | | | | | Attended by M/S AREVA |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : PUNE

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---------------------------------------|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 5 | 220kV Kurkumbh | 220kV | Bus Bar protection panel is not provided | | | | Y | NO | Will be attended in 4 Months | Work is in progress |
| | 220kV Theur | 220kV | Bus Bar Relay old electromechanical & Faulty. | Yes | Yes | | | | | Replaced by NR make Numerical RCS 950 |
| 6 | 220kV Sahara | 220kV | Distance protection relay for Urse line in reclaim time gives Autoreclosing | Yes | Yes | | | | | same is replaced by MICOM P 442 |
| 7 | 220kV Urse | 220kV | 220kV PGCIL line Back up & Distance protection relay low overreach problem | Yes | Yes | | | | | |
| 8 | 220kV Bale | 220kV | LBB initiation from load trimming scheme is not required. | Yes | Yes | | | | | |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Vashi

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------|---|------------------|--|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | |
| 1 | 220kV TEMGHAR | 220kV | Providing 220kV Bus - sectionalizer as per committee recommendation | | | | Yes | No | | The scheme is sent to CO vide lt. no. 3306 dtd. 30.08.14. |
| 2 | 220kV PAL-DOMBIVALI | 220kV | Providing 220kV Bus - sectionalizer as per committee recommendation. | | | | Yes | No | | The scheme is sent to CO vide lt. no. 3306 dtd. 30.08.14. |
| 3 | 220kV MULUND | 220kV | Providing 220kV Bus - sectionalizer as per committee recommendation. | | | | Yes | No | | Scheme is under preparation. |
| 4 | 220kV GIS BHANDUP | 220kV | The Siemens make SCADA is in service. The GPS & SCADA timing is not matching i.e. SCADA is not synchronized with GPS. The automatic fault record (i.e. DR) downloading is not possible due to Communication problem. | Yes | Yes | | | | | Problem attended. |
| 5 | 220kV KAMBA | 220kV | Providing 220kV Bus - sectionalizer and making 220kV Padghe-Vasai line LILO as per committee recommendation and providing PT in each section. | | | | Yes | No | | Padghe Vasai LILO portion scheme approved and order placed. Work is under process. Hybrid portion scheme is at corporate office L.No.3306 dtd. 30.08.14. |
| 6 | 220kV WADA | 220kV | The 220kV Bus -sectionalizer is not provided, it is suggested to explore the possibility of providing bus-sectionalizer CB in place of bus-sectionalizer isolator. | | | | Yes | No | | Under Scrutiny |
| 7 | 220kV TALOJA | 220kV | The 22kV Indoor s/s is to be renovated by GIS outdoor s/s | | | | Yes | No | | The scheme at CO. (L. No. CE vashi L. No. 2899 dtd. 01.08.2014). Compliance submitted on L.No. 3893 dtd. 17.12.15. |

Present Status of Protection Audit Deficiencies (A & B type) in MSETCL for the year 2013-14 as on 31/12/2015

Name of Zone : Vashi

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |
|---------|---|------------------|----------------------------------|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---------------------------------|--|
| Sr. No. | Name of S/s identified for Protection Audit | S/s voltage (kV) | Observations of protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Present Status as on 31/12/2015 | |
| | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If no, expected date to attend | | |
| 8 | 220kV Jambhul | | | No Deficiencies Observed | | | | | | | |
| 9 | 220kV Anandnagar | | | No Deficiencies Observed | | | | | | | |
| 10 | 110kV Neral | | | No Deficiencies Observed | | | | | | | |

Format for Protection Audit

Name of Utility: Gujarat Energy Transmission Corporation Ltd.

| Sr. No. | Name of Circle | Name of the Substation identified for audit | S/S Voltage (KV) | Observations of Protection Audit | Date on which audit conducted/completed | Deficiencies that can be corrected without procurement (Category A) | | | Deficiencies that involves procurment (Category B) | | | Remark (Defect) |
|---------|----------------|---|------------------|--|---|---|-----------------|-------------------------|--|-----------------|-------------------------|---|
| | | | | | | No. of Defects in Category A | Attended Yes/NO | Reason for not attended | No. of Defects in Category A | Attended Yes/NO | Reason for not attended | |
| 1 | Amreli | 132KV Barwala | 132 | Circle/ substaion wise observation report enclosed herewith. | 22/6/12 | 77 | 77 | | Nil | NA | NA | No. of Defects:-77 Attended(nos.)::-77 Pending(nos.)::- 0 |
| 2 | | 132KV Paliyad | 132 | | 19-20/6/12 | | | | | | | |
| 3 | | 220KV Dhasa | 220 | | 07/12/2012 | | | | | | | |
| 4 | | 220 KV Botad | 220 | | 17/7/2012 | | | | | | | |
| 5 | | 132KV Vallabhipur | 132 | | 21/6/12 | | | | | | | |
| 6 | | 220KV Otha | 220 | | 07/05/2012 | | | | | | | |
| 7 | | 220KV Savarkundla | 220 | | 16/7/2012 | | | | | | | |
| 8 | | 220KV Sagapara | 220 | | 07/06/2012 | | | | | | | |
| 9 | | 220KV Vartej | 220 | | 07/10/2012 | | | | | | | |
| 10 | Anjar | 220KV Anjar | 220 | Circle/ substaion wise observation report enclosed herewith. | 22/11/2013 | 97 | 97 | | Nil | NA | NA | No. of Defects:-97 Attended(nos.)::-97 Pending(nos.)::- 0 |
| 11 | | 132 KV Samakhiyali | 132 | | 23/05/2012 | | | | | | | |
| 12 | | 220KV Shivilakha | 220 | | 26/12/2013 | | | | | | | |
| 13 | | 220 KV Kukma | 220 | | 25/12/2013 | | | | | | | |
| 14 | | 220KV Nakhatrana | 220 | | 20/12/2013 | | | | | | | |
| 15 | | 220KV Nanikhakhar | 220 | | 27/12/2013 | | | | | | | |
| 16 | 220KV Tappar | 220 | 23/12/2013 | | | | | | | | | |
| 17 | Bharuch | 132KV Ankleshwar | 132 | Circle/ substaion wise observation report enclosed herewith. | 24/9/12 | 78 | 78 | | Nil | NA | NA | No. of Defects:-78 Attended(nos.)::-78 Pending(nos.)::- 0 |
| 18 | | 132KV Valia | 132 | | 23/8/12 | | | | | | | |
| 19 | | 220KV Acchalia | 220 | | 29/9/12 | | | | | | | |
| 20 | | 220 KV Wagra | 220 | | 09/06/2012 | | | | | | | |
| 21 | | 220KV Dahej | 220 | | 20/9/12 | | | | | | | |
| 22 | | 220KV Kim | 220 | | 09/05/2012 | | | | | | | |
| 23 | | 220KV Zagadia | 220 | | 22/9/12 | | | | | | | |
| 24 | | 220KV Haldarwa | 220 | | 09/07/2012 | | | | | | | |
| 25 | | 132KV Bharuch | 132 | | 18/9/12 | | | | | | | |
| 26 | Gondal | 132KV Wankaner | 132 | Circle/ substaion wise observation report enclosed herewith. | 14/02/2014 | 35 | 35 | | Nil | NA | NA | No. of Defects:-35 Attended(nos.)::-35 Pending(nos.)::- 0 |
| 27 | | 220KV Lalpar | 132 | | 02/07/2014 | | | | | | | |
| 28 | | 132KV Jasdhan | 132 | | 15/02/2014 | | | | | | | |
| 29 | | 132KV Dhrol | 132 | | 02/04/2014 | | | | | | | |
| 30 | | 220KV Gondal | 220 | | 22/02/2014 | | | | | | | |
| 31 | | 132KV Vajdi | 132 | | 03/05/2014 | | | | | | | |
| 32 | | 220KV Nyara | 220 | | 26/02/2014 | | | | | | | |
| 33 | | 132KV Vikram | 132 | | 02/07/2014 | | | | | | | |
| 34 | 220KV Morbi | 220 | 02/05/2014 | | | | | | | | | |

| Sr. No. | Name of Circle | Name of the Substation identified for audit | S/S Voltage (KV) | Observations of Protection Audit | Date on which audit conducted/completed | Deficiencies that can be corrected without procurement (Category A) | | | Deficiencies that involves procurement (Category B) | | | Remark (Defect) |
|---------|----------------|---|------------------|--|---|---|-----------------|-------------------------|---|-----------------|-------------------------|---|
| | | | | | | No. of Defects in Category A | Attended Yes/NO | Reason for not attended | No. of Defects in Category A | Attended Yes/NO | Reason for not attended | |
| 35 | Himmatnagar | 132KV Idar | 132 | Circle/ substaion wise observation report enclosed herewith. | 19/6/12 | 93 | 93 | | Nil | NA | NA | No. of Defects:-93 Attended(nos.): -93 Pending(nos.): - 0 |
| 36 | | 132KV Visanagar | 132 | | 20/6/12 | | | | | | | |
| 38 | | 220KV Agiyol | 220 | | 06/10/2012 | | | | | | | |
| 39 | | 220KV Bhutiya | 220 | | 06/10/2012 | | | | | | | |
| 40 | | 220KV Jamla | 220 | | 27/6/12 | | | | | | | |
| 41 | | 220KV Vijapur | 220 | | 30/6/12 | | | | | | | |
| 42 | | 220KV Dhansura | 220 | | 22/6/12 | | | | | | | |
| 43 | | 132KV Talod | 132 | | 07/04/2012 | | | | | | | |
| 43 | | 132 KV Tilakwada | 132 | | 23/6/12 | | | | | | | |
| 44 | Jambuva | 132 KV Vasedi | 132 | Circle/ substaion wise observation report enclosed herewith. | 30/4/13 | 125 | 125 | | Nil | NA | NA | No. of Defects:-125 Attended(nos.): -125 Pending(nos.): - |
| 45 | | 220KV Godhra | 220 | | 05/03/2013 | | | | | | | |
| 46 | | 132KV Dahod | 132 | | 22/5/13 | | | | | | | |
| 47 | | 220KV Jambuva | 220 | | 05/07/2013 | | | | | | | |
| 48 | | 220KV Chandrapura | 220 | | 24/05/2013 | | | | | | | |
| 49 | | 220KV Gavasad | 220 | | 24/5/13 | | | | | | | |
| 50 | | 132KV Gotri | 132 | | 25-6-2013 | | | | | | | |
| 51 | | 220KV Waghodia | 220 | | 07/02/2013 | | | | | | | |
| 52 | | 132KV J' Nagar | 132 | | 30/6/2013 | | | | | | | |
| 53 | | 132KV F" Nagar | 132 | | 31-6-2013 | | | | | | | |
| 54 | | 132KV Karjan | 132 | | 06/11/2013 | | | | | | | |
| 55 | | 132KV Manjusar | 132 | | 07/03/2013 | | | | | | | |
| 56 | | 132 KV Limkheda | 132 | | 30-6-2013 | | | | | | | |
| 57 | | 132KV Nandesari | 132 | | 06/02/2013 | | | | | | | |
| 57 | Jamnagar | 220KV Ranavav | 220 | Circle/ substaion wise observation report enclosed herewith. | 20/02/2014 | 28 | 28 | | Nil | NA | NA | No. of Defects:-28 Attended(nos.): -28 Pending(nos.): - 0 |
| 58 | | 132KV Bhatia | 132 | | 21/02/2014 | | | | | | | |
| 59 | | 220KV Jamnagar | 220 | | 14/02/2014 | | | | | | | |
| 60 | | 132KV Khambhalia | 132 | | 14/02/2014 | | | | | | | |
| 61 | | 132KV Naghedi | 132 | | 14/02/2014 | | | | | | | |

| Sr. No. | Name of Circle | Name of the Substation identified for audit | S/S Voltage (KV) | Observations of Protection Audit | Date on which audit conducted/completed | Deficiencies that can be corrected without procurement (Category A) | | | Deficiencies that involves procurement (Category B) | | | Remark (Defect) |
|---------|----------------|---|------------------|--|---|---|-----------------|-------------------------|---|-----------------|-------------------------|--|
| | | | | | | No. of Defects in Category A | Attended Yes/NO | Reason for not attended | No. of Defects in Category A | Attended Yes/NO | Reason for not attended | |
| 62 | Junagadh | 132 KV Bhayavadar | 132 | Circle/ substaion wise observation report enclosed herewith. | 18/8/12 | 89 | 89 | | Nil | NA | NA | No. of Defects:-89 Attended(nos.)::-89 Pending(nos.)::- 0 |
| 63 | | 132KV Junagadh | 132 | | 09/07/2012 | | | | | | | |
| 64 | | 220KV Keshod | 220 | | 09/08/2012 | | | | | | | |
| 65 | | 132 KV Dhoraji | 132 | | 22/8/12 | | | | | | | |
| 66 | | 220KV Motipaneli | 220 | | 24/08/2012 | | | | | | | |
| 67 | | 220KV Sardargadh | 220 | | 09/07/2012 | | | | | | | |
| 68 | | 220KV Visavadar | 220 | | 25/6/12 | | | | | | | |
| 69 | | 132KV Haripur | 132 | | 26/6/12 | | | | | | | |
| 70 | | 132KV Talala | 132 | | 27/6/12 | | | | | | | |
| 71 | | 220KV Timbdi | 220 | | 07/02/2012 | | | | | | | |
| 72 | | 220 KV Kansari(Dhokalva) | 220 | | 07/04/2012 | | | | | | | |
| 73 | Mehsana | 132 KV Patan | 132 | Circle/ substaion wise observation report enclosed herewith. | 12/02/2013 | 41 | 41 | | Nil | NA | NA | No. of Defects:-41 Attended(nos.)::-41 Pending(nos.)::- 0 |
| 74 | | 132 KV Siddhpur | 132 | | 27/11/2013 | | | | | | | |
| 75 | | 220KV Kheralu | 220 | | 26/12/2013 | | | | | | | |
| 76 | | 220KV Sankhari | 220 | | 29/11/2013 | | | | | | | |
| 77 | | 220KV Chhatral | 220 | | 21/11/2013 | | | | | | | |
| 78 | | 220KV Mehsana | 220 | | 21/12/2013 | | | | | | | |
| 79 | 220KV Mitha | 220 | 12/10/2013 | | | | | | | | | |
| 80 | Nadiad | 132 KV Sabarmati | 132 | Circle/ substaion wise observation report enclosed herewith. | 05/12/2012 | 266 | 266 | | Nil | NA | NA | No. of Defects:-266 Attended(nos.)::-266 Pending(nos.)::-0 |
| 81 | | 220KV Salejada | 220 | | 30/5/12 | | | | | | | |
| 82 | | 132KV Ode | 132 | | 30/4/12 | | | | | | | |
| 83 | | 132KV Undel | 132 | | 20/05/12 | | | | | | | |
| 84 | | 220KV Kapadwanj | 220 | | 06/09/2012 | | | | | | | |
| 85 | | 220 KV Bhat | 220 | | 31/05/12 | | | | | | | |
| 86 | | 132KV Narol | 132 | | 22/05/12 | | | | | | | |
| 87 | | 132KV Chiloda | 132 | | 24/7/12 | | | | | | | |
| 88 | | 220KV Karamsad | 220 | | 29/4/12 | | | | | | | |
| 89 | | 220KV Ranasan | 220 | | 17/05/12 | | | | | | | |
| 90 | | 132KV Mahemdabad | 132 | | 19/05/12, 15/7/2012 | | | | | | | |
| 91 | | 220KV Khanpur | 220 | | 19/7/12 | | | | | | | |
| 92 | 132KV Nadiad | 132 | 18/05/12 | | | | | | | | | |

| Sr. No. | Name of Circle | Name of the Substation identified for audit | S/S Voltage (KV) | Observations of Protection Audit | Date on which audit conducted/completed | Deficiencies that can be corrected without procurement (Category A) | | | Deficiencies that involves procurement (Category B) | | | Remark (Defect) |
|---------|----------------|---|------------------|--|---|---|-----------------|-------------------------|---|-----------------|-------------------------|--|
| | | | | | | No. of Defects in Category A | Attended Yes/NO | Reason for not attended | No. of Defects in Category A | Attended Yes/NO | Reason for not attended | |
| 93 | Navsari | 220KV Bhilad | 220 | Circle/ substaion wise observation report enclosed herewith. | | 90 | 90 | | Nil | NA | NA | No. of Defects:-90 Attended(nos.)::-90 Pending(nos.)::- 0 |
| 94 | | 220KV Talangpore | 220 | | 08/06/2013 | | | | | | | |
| 95 | | 220KV Ambheta | 220 | | 25/5/13 | | | | | | | |
| 96 | | 132KV Atul | 132 | | 16/05/12 | | | | | | | |
| 97 | | 132 KV Bhestan | 132 | | 06/10/2013 | | | | | | | |
| 98 | | 220KV Ichhapore | 220 | | 06/07/2013 | | | | | | | |
| 99 | | 220KV Mota | 220 | | 05/11/2013 | | | | | | | |
| 100 | | 220KV Navasari | 220 | | 22/5/13 | | | | | | | |
| 101 | | 220KV Vapi | 220 | | 09/02/2013 | | | | | | | |
| 102 | | 220KV VAV | 220 | | 05/09/2013 | | | | | | | |
| 103 | Palanpur | 220 KV Thavar | 220 | Circle/ substaion wise observation report enclosed herewith. | 09/05/2012 | 52 | 52 | | Nil | NA | NA | No. of Defects:-52 Attended(nos.)::-52 Pending(nos.)::- 0 |
| 104 | | 220KV Tharad | 220 | | 09/01/2012 | | | | | | | |
| 105 | | 132 KV Deesa | 132 | | 09/06/2012 | | | | | | | |
| 106 | | 220KV Deodar | 220 | | 09/11/2012 | | | | | | | |
| 107 | | 220KV Jangral | 220 | | 25/8/12 | | | | | | | |
| 108 | | 220KV Palanpur | 220 | | 22/8/12 | | | | | | | |
| 109 | | 220KV Radhanpur | 220 | | 14/9/12 | | | | | | | |
| 110 | | 220KV Agarthala | 220 | | 29/8/12 | | | | | | | |
| 111 | Surendranagar | 132KV Dhandhuka | 132 | Circle/ substaion wise observation report enclosed herewith. | 29/1/2013 | 120 | 120 | | Nil | NA | NA | No. of Defects:-120 Attended(nos.)::-120 Pending(nos.)::-0 |
| 112 | | 132KV Sitagadh | 132 | | 30/1/2013 | | | | | | | |
| 113 | | 132KV DHANKDHRA | 132 | | 23/1/2013 | | | | | | | |
| 114 | | 220KV Halvad | 220 | | 25/1/2013 | | | | | | | |
| 115 | | 220KV Limbdi | 220 | | 31/1/2013 | | | | | | | |
| 116 | | 220KV Viragam | 220 | | 28/02/2013 | | | | | | | |
| 117 | | 220 KV DUDHREJ | 220 | | 02/02/2013 | | | | | | | |
| 118 | | 220 KV RAJPAR | 220 | | 02/05/2013 | | | | | | | |
| 119 | | 220 KV BALA | 220 | | 02/06/2013 | | | | | | | |
| 120 | | 220 KV ADALSAR | 220 | | 23/01/2013 | | | | | | | |
| 121 | | 220 KV DHANKI | 220 | | 03/05/2013 | | | | | | | |

PROTECTION AUDIT DEFICIENCIES/OBSERVATIONS COMPLIANCE [As on 31.12.2015]

| Name of Utility : CHHATTISGARH POWER TRANSMISSION COMPANY LIMITED | | | | | | | | | | | |
|--|--------------------|---|-------------------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---------|
| Name of S/S identified for protection audit | S/S voltage | Name of 3rd party protection audit agency | Date on which audit conducted | Observations of protection audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remarks |
| | | | | | Yes / No | Whether attended Yes/No | If not attended, reason | Yes / No | Whether attended Yes/No | If no, expected date to attend | |
| 400 KV Khedamara | 400/ 220 KV | NTPC/PGCIL & CSPTCL Engineers | 19 - 20 Feb'13 | DC leakage to be monitored | Yes | Yes | | | | | |
| 220 KV Bemetara | 220/ 132 KV | CSPTCL Engineers | 13.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. | S.No. 5 | Yes | - | Yes for S.No. 1 to 4 | No | 31.10.16 | - |
| 220 KV Gurur | 220/ 132 KV | CSPTCL Engineers | 12.03.13 | 1. Carrier protection is not available.. 2. M II protection for 220 KV feeder not available. 3.DC leakage to be monitored. | S.No. 3 | Yes | - | Yes for S.No. 1 & 2 | No | 31.10.16 | - |
| 220 KV Sohela | 220/ 132 KV | CSPTCL Engineers | 22.03.13 | 1. Carrier protection is not available.. 2. GPS time synchronizing facility is not available. 3. M II protection for 220 KV feeder not available. 4. DC leakage to be monitored. | S.No. 4 | Yes | - | Yes for S.No. 1 to 3 | No | 31.10.16 | - |
| 220 KV Bhatapara | 220/ 132 KV | CSPTCL Engineers | 23.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. 6. LBB protection not available. | S.No. 5 | Yes | - | Yes for S.No. 1 to 6 except 5 | No | 31.10.16 | - |
| 220 KV Mopka | 220/ 132 KV | CSPTCL Engineers | 29.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. 6. LBB protection not available. 7. Synchronization trolley not available. | S.No. 5 | Yes | - | Yes for S.No. 1 to 7 except 5 | No | 31.10.16 | - |

| Name of S/S identified for protection audit | S/S voltage | Name of 3rd party protection audit agency | Date on which audit conducted | Observations of protection audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remarks |
|---|-------------|---|-------------------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|----------------------------------|
| | | | | | Yes / No | Whether attended Yes/No | If not attended, reason | Yes / No | Whether attended Yes/No | If no, expected date to attend | |
| 220 KV Banari | 220/ 132 KV | CSPTCL Engineers | 29.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. 6. LBB protection not available. | S.No. 5 | Yes | - | Yes for S.No. 1 to 6 except 5 | No | 31.10.16 | - |
| 220 KV Siltara | 220/ 132 KV | CSPTCL Engineers | 01.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. 6. LBB protection not available. 7. Synchronization trolley not available. | S.No. 2&5 | Yes | - | Yes for S.No. 1 & 3 to 7 | No | 31.10.16 | 2nd Battery set commissioned. |
| 220 KV Doma, Raipur | 220/132 KV | CSPTCL Engineers | 22.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. | S.No. 5 | Yes | - | Yes for S.No. 1 to 4 | No | 31.10.16 | - |
| 220 KV Paraswani | 220/132 KV | CSPTCL Engineers | 29.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. | S.No. 2&5 | Yes | - | Yes for S.No. 1,3& 4 | No | 31.10.15 | Second battery set commissioned. |
| 220 KV Urla | 220/ 132 KV | CSPTCL Engineers | 23.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. 6. LBB protection not available. | S.No. 2&5 | Yes | - | Yes for S.No. 1,3,4& 6 | No | 31.10.16 | Second battery set commissioned. |

| Name of S/S identified for protection audit | S/S voltage | Name of 3rd party protection audit agency | Date on which audit conducted | Observations of protection audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remarks |
|---|-------------|---|-------------------------------|---|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|----------------------------------|
| | | | | | Yes / No | Whether attended Yes/No | If not attended, reason | Yes / No | Whether attended Yes/No | If no, expected date to attend | |
| 220 KV Thelkadih | 220/132 KV | CSPTCL Engineers | | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. | S.No. 2&5 | Yes | - | Yes for S.No. 1,3& 4 | No | 31.10.16 | Second battery set commissioned. |
| 220 KV Barsoor | 220/132 KV | CSPTCL Engineers | 07.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. 6. LBB protection not available. | S.No. 2&5 | Yes | - | Yes for S.No. 1 & 3,4& 6 | No | 31.10.16 | Second battery set commissioned. |
| 220 KV Bhilai | 220/132 KV | CSPTCL Engineers | 11.03.13 | 1. Carrier protection is not available. 2. M II protection for 220 KV feeder not available. 3. DC leakage to be monitored. 4. LBB protection not available. | S.No. 3 | Yes | - | Yes for S.No. 1 to 4 except 3 | No | 31.10.16 | - |
| 220 KV Kotmikala | 220/ 132 KV | CSPTCL Engineers | 05.04.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. 6. LBB protection not available. 7. Synchronization trolley not available. | S.No. 5 | Yes | - | Yes for S.No. 1 to 7 except 5 | No | 31.10.16 | - |
| 220 KV Raigarh | 220/ 132 KV | CSPTCL Engineers | 20.03.13 | 1. Carrier protection is not available.. 2. 2nd DC battery set is not available. 3. GPS time synchronizing facility is not available. 4. M II protection for 220 KV feeder not available. 5. DC leakage to be monitored. 6. LBB protection not available. 7. Synchronization trolley not available. | S.No. 5 | Yes | - | Yes for S.No. 1 to 7 except 5 | No | 31.10.16 | - |

| Name of S/S identified for protection audit | S/S voltage | Name of 3rd party protection audit agency | Date on which audit conducted | Observations of protection audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remarks |
|--|-------------|---|-------------------------------|--|---|--|--|---|-------------------------|--------------------------------|--|
| | | | | | Yes / No | Whether attended Yes/No | If not attended, reason | Yes / No | Whether attended Yes/No | If no, expected date to attend | |
| Name of Utility : CHHATTISGARH POWER GENERATION COMPANY LIMITED | | | | | | | | | | | |
| 220 KV KTPS, Korba (E) | 220 KV | M.K.Banchhor CSPTCL, N.P.Dewangan NTPC, N.K.Bizora CSPGCL, G.P.Rai CSPGCL, S.C.Chakraborty CSPGCL | 25.04.2013 | 1. Separate two sets DC system is recommended for switchyard protection | No | | | Yes | | | Estimate and Requisition for separate DC source has been sent for approval. |
| | | | | 2. Carrier Protection is out of service. | Yes | Yes, for 220 kV Korba East-West I/C No. I&II | Rest feeder's carrier prot. ckt checked & found deficiencies | | | | For carrier protection panel/cards procurement required. |
| | | | | 3. Disturbance Recorder and SERs are not available. | | | | Yes | | | Tenders opened & procurement under progress. |
| | | | | 4. Old THR make Static DPR relays needs to be replaced by numerical relays | No | | | Yes | NA | NA | Numerical Relays procured . Retrofitting /commisioning will be taken up soon. |
| | | | | 5. Auto re-closer is not available. | Yes | No | Checking of circuits under progress. | | | | Auto reclose of 220 KV Korba-Budipadar ckt-3 is checked & put in service.In other feeders A/R ckts is OK and will be put in service after confirmation from other end. |
| | | | | 6. Bus Bar Differential scheme is not available. | | | | Yes | | | |
| | | | | 7. All relay settings are verified and found to be generally in order. | Yes | Yes | | | | | |
| | | | | 8. Multiple Earthing is not found in CT secondary. | Yes | Yes | | | | | |
| | | | | 9. PSB feature is Enabled for Z2, Z3, and Z4. | Yes | Yes | | | | | |

| Name of S/S identified for protection audit | S/S voltage | Name of 3rd party protection audit agency | Date on which audit conducted | Observations of protection audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remarks |
|---|---------------|--|-------------------------------|--|---|-------------------------|---|---|-------------------------|--------------------------------|---------|
| | | | | | Yes / No | Whether attended Yes/No | If not attended, reason | Yes / No | Whether attended Yes/No | If no, expected date to attend | |
| | | | | 10. Synchronizing Panel is available for all feeders except Budhipadar Feeder No-III for that individual Synchronizing Trolley has provided. | Yes | Yes | | | | | |
| 220 KV DSPMTPS, Korba | 220 KV | Third Party Protection Audit was carried out by SE(ET&I) HTPS,CSPGCL,Representative of NTPC,EE,CSP TCL,EE(Testing),DSPMTPS, CSPGCL | 25.04.2013 | 1) Two independent source of 220 V DC are available in Switchyard.No DC leakage observed. | YES | YES | | | | | |
| | | | | 2) All relay settings are verified & found generally in order. | YES | YES | | | | | |
| | | | | 3)Dual channel carrier protection is available in all 220 KV feeders but kept out | YES | No | Due to non availability of Panel at remote end. | | | | |
| | | | | 4) DRs are available in Numeric relays and SER is available. | YES | YES | | | | | |
| | | | | 5)Multiple earthing of CT secondary core is not available.CT secondary earthing is provided in Panel only. | YES | YES | | | | | |
| | | | | 6) 01 no synchronising trolley is available & in working condition. | YES | YES | | | | | |
| | | | | 7)PSB feature is enabled & in blocking condition for Z2,Z3 & Z4. | YES | YES | | | | | |
| | | | | 8) Auto reclose is available but presently kept out. | YES | No | As carrier protection is out. | | | | |
| | | | | 9) Bus Bar differential scheme is available but presently kept out. | YES | No | To be checked before put in service | | | | |

| Name of S/S identified for protection audit | S/S voltage | Name of 3rd party protection audit agency | Date on which audit conducted | Observations of protection audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remarks |
|---|-------------|---|-------------------------------|--|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---|
| | | | | | Yes / No | Whether attended Yes/No | If not attended, reason | Yes / No | Whether attended Yes/No | If no, expected date to attend | |
| Korba West TPS | 400 KV | NTPC & CSPTCL Engineers | 26.04.2013 | 1) Non availability of Main-II protection | | | | | Yes | | ABB Make Relay & control panels equipped with Main-I & Main-II protection and Auto reclose of feeders have been commissioned. |
| | | | | 2) Non availability of Auto reclose scheme. | | | | | Yes | | |
| | | | | 3) Non availability of B/B differential & LBB protection | | | | Yes | No | 31.03.2016 | Bus Bar protection panel has been installed & laying of cables is in progress. |
| | | | | 4)GPS is available however no relay is synchronised with it. | | | | Yes | YES | 31.05.2014 | Relays have been synchronised with new GPS. |
| | | | | 5) Replacement of ABCB with SF6 breakers & commissioning of isolator sequential operation with ABCB opening. | | | | Yes | No | 31.03.2017 | Replacement of ABCB with SF6 breakers is included in the scope of work of R&M of station proposed in year 2016-17 |

| Name of S/S identified for protection audit | S/S voltage | Name of 3rd party protection audit agency | Date on which audit conducted | Observations of protection audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remarks | |
|---|-------------|---|-------------------------------|---|---|---|-------------------------|---|-------------------------|--------------------------------|---|--|
| | | | | | Yes / No | Whether attended Yes/No | If not attended, reason | Yes / No | Whether attended Yes/No | If no, expected date to attend | | |
| Korba West TPS | 220 KV | NTPC & CSPTCL Engineers | 26.04.2013 | 1) Second DC system is recommended . | | | | Yes | No | 31.03.2017 | Proposed in the year 16-17 in Refurbish Scheme. | |
| | | | | 2) To renovate/retrofit Main-I & Main-II Protection with numeric relays in all out going feeders. | | | | | Yes | | | Main-I & Main-II Protection with numeric relays in all out going feeders completed on 28.12.2014 |
| | | | | 3) Carrier Protection is not in service. | | 02 no. have been commissioned in KEB-KWB inter connectors | | Yes | No | 31.03.2016 | In KEB-KWB interconnector I & II carrier protection has been taken in service.In KW-DSPM I/C,action from DSPM is awaited.Other 3 feeders falls under CSPTCL scope | |
| | | | | 4) Disturbance Recoder and SER s are not available. | | | | Yes | No | 31.03.2016 | Bay control panels for SCADA system have been received .M/s ABB is being persuaded to commission the same as early as possible. | |
| | | | | 5) Non availability of Auto reclose scheme. | | | | Yes | No | 31.03.2016 | Scheme is ready from KWB end,waiting for consent for connected sub stations. | |
| | | | | 6) Non availability of B/B differential | | | | Yes | No | 31.03.2016 | Work under progress. | |

| Name of S/S identified for protection audit | S/S voltage | Name of 3rd party protection audit agency | Date on which audit conducted | Observations of protection audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remarks |
|---|-------------|---|-------------------------------|--|---|-------------------------|-------------------------|---|-------------------------|--------------------------------|---|
| | | | | | Yes / No | Whether attended Yes/No | If not attended, reason | Yes / No | Whether attended Yes/No | If no, expected date to attend | |
| | | | | 7) Non availability of LBB protection | Yes | YES | | | | | LBB has been kept in service |
| | | | | 8)GPS is available however no relay is synchronised with it. | | | | Yes | No | 31.03.2016 | After commissioning of SCADA panel, Relays will be synchronised.GPS facility is available in SCADA. |

Name of Utility - MADHYA PRADESH POWER TRANSMISSION CO. LTD JABALPUR

| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|--|---|------------------------|------------------------|---|------------------------|--------------------------------|------------------------|
| | | | | | | Yes/No | Wether attended Yes/No | if not attended reason | Yes/No | Wether attended Yes/No | if no, expected date to attend | |
| 1 | 400KV S/S Bhopal | 400KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 17-01-13 to 18-01-13 | 1. Time synchronisation problem of protective relays with GPS. | Yes | Yes | NIL | NIL | NIL | NIL | Work in progress |
| | | | | | 2. Providing of Separate Event Logger | NIL | NIL | NIL | YES | NO | 4 months | |
| | | | | | 3. Providing of adequate fire protection system. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Replacement of 220KV Static Bus Bar system with Numeric | NIL | NIL | NIL | YES | YES | NIL | |
| | | | | | 5. Providing of additional Backup element on 315MVA Transformer -III | Yes | Yes | NIL | NIL | NIL | NIL | |
| 2 | 220KV S/S Bhopal | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22-04-13 to 23-04-13 | 1. Replacement of 1No 132KV NGEF SF6 CB of BHEL Bay | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. Replacement of Electromechanical O/C & E/F relays of Incomers with numerical relays. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Provision for taking REF protection in Circuit on 160MVA, 3x40MVA and 100MVA Transformers | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Providing of Additional wave trap on 220KV Inter Connector-II | Yes | Yes | NIL | NIL | NIL | NIL | |
| 3 | 220KV S/S Mandideh | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 26-04-13 to 27-04-13 | 1. LBB scheme to be taken in service | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. Providing of 220KV Bus Bar Protection Scheme | NIL | NIL | NIL | YES | YES | NIL | |
| | | | | | 3. LAs leakage Current measurement to be done | Yes | Yes | NIL | NIL | NIL | NIL | |
| 4 | 220KV S/S Bina | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 07-05-13 to 08-05-13 | 1. Replacement of Static/Electromechanical DPR by Numerical relays | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. Commissioning of new 600AH 48V Battery Charger | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3 Synchronisation of GPS system with protection of 132KV Traction-I & II feeders | Yes | Yes | NIL | NIL | NIL | NIL | |
| 5 | 220KV S/S Gwalior | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 27-04-13 to 28-04-13 | 1. Zone-III setting of 220KV Gwalior-Bina-I & II to be reviewed | Yes | Yes | NIL | NIL | NIL | NIL | Procurement in process |
| | | | | | 2 Extending GPS time synchronising facility to all panels | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3 220KV Bus Bar scheme to be provided | NIL | NIL | NIL | YES | YES | NIL | |
| | | | | | 4. Providing of NIFPS on 3x40MVA 220/132KV Transformer | NIL | NIL | NIL | YES | NO | Matter is under consideration. | |
| | | | | | 5. Providing of DG set | NIL | NIL | NIL | YES | NO | 6 months | |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|-----|---|-----|----------|------------------|
| | | | | | | Yes | Yes | NIL | NIL | NIL | NIL | |
| 6 | 400KV S/S Bina | 400KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 12-02-13 to 13-02-13 | 1. 33KV, 25MVAR reactor of 315MVA Tr-I to be taken back in service by replacement of R phase 33KV Bushing and repair of 33KV CB. | Yes | Yes | NIL | NIL | NIL | NIL | Work in progress |
| | | | | | 2. Oil leakage from B phase Turret of 400KV Bushing of 315MVA No-I | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. 33KV, 25MVAR reactor of 315MVA Tr-II to be taken back in service by replacement of R phase 33KV Bushing and repair of 33KV CB. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Mixing of 220V DC source-I & II to be rectified | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. Replacement of B phase CVT of 400KV Main Bus-II | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 6. Auto Check synchronising facility is not in service | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 7. Extending GPS connectivity to balance DPRs and Differential relays | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 8. Providing of Separate Event Logger | NIL | NIL | NIL | YES | NO | 4 months | |
| | | | | | 9. Connecting 220KV Bus Bar Panel for tripping | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 10. Testing of DPR of 220KV Interconnector-II | Yes | Yes | NIL | NIL | NIL | NIL | |
| 7 | 400KV S/S Katni | 400KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 17-01-13 to 18-01-13 | 1. Providing of Emergency light in Control and Battery Room | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. Providing GPS connectivity in 400KV Controlpanels | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. DG set not provided | NIL | NIL | NIL | YES | YES | NIL | |
| | | | | | 4. 400KV Bus Bar protection out of service | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. High resistance of Earth pit of 220KV PGCIL-II bay | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 6. 220KV side LBB to be commissioned | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 7. Directional E/F feature to be enabled on 220KV Birsinghpur and Damoh feeder. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 8. REF protection on 160MVA TELK Tr. To be enabled | Yes | Yes | NIL | NIL | NIL | NIL | |

Name of Utility - MADHYA PRADESH POWER TRANSMISSION CO. LTD JABALPUR

| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|-----|---|-----|--------------------------------|------------------------|
| | | | | | | Yes | Yes | NIL | NIL | NIL | NIL | |
| 8 | 220KV S/S Malanpur | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 01-05-13 to 02-05-13 | 1. Relay setting of 132KV Malanpur-Banmore-I feeder to be reviewed | Yes | Yes | NIL | NIL | NIL | NIL | Procurement in process |
| | | | | | 2. Zone-III setting of 220KV Malanpur-Auraiya feeder to be reviewed | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Providing of DG set | NIL | NIL | NIL | YES | NO | 6 Months | |
| | | | | | 4. DC leakage in 110V DC system to be removed | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. GPS time synchronising to be extended to Transformer panels | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 6. Providing of NIFPS on 160MVA 220/132KV Transformer-II | NIL | NIL | NIL | YES | NO | Matter is under consideration. | |
| | | | | | 7. 220KV Bus Bar protection to be taken into circuit for tripping | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 8. Earth resistance of 20 and 40MVA transformer pits are not taken | Yes | Yes | NIL | NIL | NIL | NIL | |
| 9 | 220KV S/S Mehgaon | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 29-04-13 to 30-04-13 | 1. SSRR3V scheme on 132KV Bhind feeder to be replaced | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. 220KV and 132KV feeder DPRs Zone-II & III settings to be reviewed | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. DC leakage in 110V DC system to be removed | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. GPS time synchronising facility to be extended to 132KV Bhind,Seondha feeder and 160MVA BBL Transformer panels | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. Providing of NIFPS on 160MVA 220/132KV Transformer-II | NIL | NIL | NIL | YES | NO | Matter is under consideration. | |
| | | | | | 6. 220KV Bus Bar protection scheme to be taken into circuit after configuration of new 160MVA BBL transformer | Yes | Yes | NIL | NIL | NIL | NIL | |
| 10 | 220KV S/S Shujalpur | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 24-04-13 to 25-04-13 | 1. 220KV Bus Bar scheme to be provided | NIL | NIL | NIL | YES | YES | NIL | Recently commissioned |
| | | | | | 2. 160MVA Transformer I & II panels are synchronised with GPS system, other panels needs to be synchronised | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Oil temp. indicator is not available in 20MVA Transformer | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Earth resistance measurement to be done | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. Zone-II & III settings of DPRs of 220KV PGCL,132KV Arniya feeders to be checked | Yes | Yes | NIL | NIL | NIL | NIL | |

Name of Utility - MADHYA PRADESH POWER TRANSMISSION CO. LTD JABALPUR

| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|-----|---|-----|----------|------------------------|
| | | | | | | Yes | Yes | NIL | NIL | NIL | NIL | |
| 11 | 220KV S/S Hoshangabad | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 08-05-13 to 09-05-13 | 1. CT junction Box earthing in 132KV Bays to be strengthen | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. 220KV and 132KV CB Marshalling Box earthing to be checked and strengthen | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3 IOC feature in Differential and DPR relays to be enabled from reliability point of view | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Over fluxing alarm and Trip time settings may be verified and corrected | Yes | Yes | NIL | NIL | NIL | NIL | |
| 12 | 220KV S/S Itarsi | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 06-05-13 to 07-05-13 | 1. AREVA make 220KV CB marshalling Boxes are not properly earthed | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. Minor DC leakage found in 110V DC source-II | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Five nos DPRs (220KV Handiya-I&II, Barwaha,Sarni-III and Transfer B/C) are not time synchronised with GPS | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Auto reclosed feature is to be made operational | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. LBB and Bus Bar protection scheme have to be taken in to circuit | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 6. H.Set feature of Differential relays to be enabled | Yes | Yes | NIL | NIL | NIL | NIL | |
| 13 | 220KV S/S South Zone Indore | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22-04-13 to 23-04-13 | 1. GPS is installed but not functioning, to be taken into service | Yes | Yes | NIL | NIL | NIL | NIL | Procurement in process |
| | | | | | 2. 220KV Bus Bar protection scheme is ASEA make needs to be replaced with numerical scheme | NIL | NIL | NIL | YES | YES | NIL | |
| | | | | | 3. Providing of DG set | NIL | NIL | NIL | YES | NO | 6 months | |
| | | | | | 4 Numeric DPR on 220KV Jetpura feeder to be provided | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5 DTOC setting of Transformers may be reviewed with latest fault level and CT ratio | Yes | Yes | NIL | NIL | NIL | NIL | |
| 14 | 220KV S/S Pithampur | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 24-04-13 to 25-04-13 | 1. GPS is installed but intermittent outage of GPS has been reported, needs to be discussed with manufacturer | Yes | Yes | NIL | NIL | NIL | NIL | Procurement in process |
| | | | | | 2. Uniformity in settings of both 160MVA transformers may be reviewed | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Rajgarh-II DPR relay setting to be reviewed for Phase/Ground Impedance for Zone-III | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Providing of DG set | NIL | NIL | NIL | YES | NO | 6 months | |
| | | | | | 5 V/F protection in any of Differential relay on 132/33KV Transformers not enabled | Yes | Yes | NIL | NIL | NIL | NIL | |

Name of Utility - MADHYA PRADESH POWER TRANSMISSION CO. LTD JABALPUR

| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|--|---|-----|----------|--------------------------------|
| | | | | | | Yes | No | NIL | Yes | No | NIL | |
| 15 | 2220KV S/S Barwaha | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 26-04-13 to 27-04-13 | 1. Some numerical relays are not time synchronised with GPS | Yes | Yes | NIL | NIL | NIL | NIL | Procurement in process |
| | | | | | 2. 220KV Bus Bar protection scheme is ASEA make needs to be replaced with numerical scheme | NIL | NIL | NIL | YES | YES | NIL | |
| | | | | | 3. V/F setting for 3x40MVA, 63MVA ,40MVA is not enabled | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. REF is not enabled in 220KV and 132KV Transformers, to be enabled | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5 LBB protection for 220KV Class Transformers to be commissioned | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Providing of DG set | NIL | NIL | NIL | YES | NO | 6 months | |
| 16 | 220KV S/S Jabalpur | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 24-04-13 to 25-04-13 | 1. GPS system for relay time synchronisation is out of order | Yes | Yes | NIL | NIL | NIL | NIL | Matter is under consideration. |
| | | | | | 2. Automatic Fire Protection System(NIFPS) to be installed on all Transformers | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Fire extinguishers are available but to be placed at appropriate locations as per requirement. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Air Conditioning system should be provided in the Control Room | NIL | NIL | NIL | YES | NO | | |
| 17 | 220KV S/S Rewa | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 29-04-13 to 30-04-13 | 1 Bus Bar protection system is provided but is in alarm mode only. | Yes | Yes | NIL | NIL | NIL | NIL | Matter is under consideration. |
| | | | | | 2. 110V DC System is having earth leakage problem | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Automatic Fire Protection System (NIFPS)to be installed on all Transformers | NIL | NIL | NIL | YES | NO | | |
| | | | | | 4. Synchronising scheme must be provided as many Hydel Generators are connected to the 220KV and 132KV Bus. | Yes | Yes | At S/S end it is not required as it is provided at Generating S/S end. | NIL | NIL | NIL | |
| | | | | | 5. Lighting Visibility in the Control Room should be increased | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 6. Fire extinguishers are available but to be placed at appropriate locations as per requirement. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 7. REF feature in 160MVA CGL is not enabled. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 8. Load dropping scheme on Transformers must be connected. | Yes | Yes | NIL | NIL | NIL | NIL | |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|-----|---|-----|--------------------------------|-----------------------|
| | | | | | | Yes | Yes | NIL | NIL | NIL | NIL | |
| 18 | 220KV S/S Satna | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 01-05-13 to 02-05-13 | 1. GPS system is available but the relays are not connected to it. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. Bus Bar and LBB protection of B-90 Bus Bar protection scheme is not in service due to Y phase CT module defect. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Earth leakage problem in 110V DC system is there. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. REF feature in 160MVA BHEL is not enabled. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. Automatic Fire Protection System(NIFPS) to be installed on 160MVA AREVA Transformer | NIL | NIL | NIL | YES | NO | Matter is under consideration. | |
| | | | | | 6. REF protection is not available on 160MVA BHEL transformer | Yes | Yes | NIL | NIL | NIL | NIL | |
| 19 | 220KV S/S Damoh | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 06-05-13 to 07-05-13 | 1. Oil leakage observed from 33KV Tertiary Bushing Turret of BHEL Transformer | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. Fire extinguishers are not available at Control Room | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Providing of Emergency light in Control room | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Internal panel cabling/Wiring of Control panel is meshed | Yes | Yes | NIL | NIL | NIL | NIL | |
| 20 | 220KV S/S Sagar | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 09-05-13 to 10-05-13 | 1. GPS system is not connected with all relays | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. 48V Battery Charged is working in only Boost mode. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Automatic Fire Protection System (NIFPS) to be installed on both Transformers | NIL | NIL | NIL | YES | NO | Matter is under consideration. | |
| | | | | | 4. 220KV Bus Bar scheme to be provided | NIL | NIL | NIL | YES | YES | NIL | |
| 21 | 220KV S/S Barod | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 24-04-13 to 25-04-13 | 1. GPS system is available but some relays are not connected to it. | Yes | Yes | NIL | NIL | NIL | NIL | |
| 22 | 220KV S/S Julwaniya | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 08-05-13 to 09-05-13 | 1. GPS system is available but some relays are not connected to it. | Yes | Yes | NIL | NIL | NIL | NIL | Recently commissioned |
| | | | | | 2. 220KV Bus Bar scheme to be provided | NIL | NIL | NIL | YES | YES | NIL | |
| | | | | | 3. V/F protection in any of Differential relay on 132/33KV Transformers not enabled | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. DTOC setting of Transformers may be reviewed with latest fault level and CT ratio | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. Float mode of 110V DC Charger is defective | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 6. In 220KV Julwaniya-Omkarshwar, Zone-III time setting is 800ms. It is not programmable as push buttons are not working and relay communication software is not available. It may be rectified soon. | Yes | Yes | NIL | NIL | NIL | NIL | |

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|---------|---|-------------|---|-------------------------------|---|---|-----|-----|---|-----|----------|------------------|
| | | | | | | Yes | Yes | NIL | NIL | NIL | NIL | |
| 23 | 220KV S/S Nimrani | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 06-05-13 to 07-05-13 | 1. GPS system is available but some relays are not connected to it. | Yes | Yes | NIL | NIL | NIL | NIL | By JULY 15 |
| | | | | | 2. 220KV Bus Bar scheme to be provided | NIL | NIL | NIL | YES | NO | 3 months | |
| | | | | | 3. Float mode of 110V DC Charger is defective | Yes | Yes | NIL | NIL | NIL | NIL | |
| 24 | 220KV S/S Indore-II Jetpura | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 08-05-13 to 09-05-13 | 1. Time synchronisation system is available with GPS, Its connectivity was made with all 220KV DPR/Differential relays. As this has created problem in functioning of DPR/Differential relays, time synchronisation system is disconnected. Rectification of the problem and connectivity of time synchronisation system with all the relays is to be done. | Yes | Yes | NIL | NIL | NIL | NIL | |
| 25 | 220KV S/S Ujjain | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 26-04-13 to 27-04-13 | 1. Time synchronisation system is available with GPS system, its connectivity is made with few 220KV & 132KV relays, Connectivity for the rest of the system is to be done. | Yes | Yes | NIL | NIL | NIL | NIL | |
| 26 | 400KV S/S Nagda | 400KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 17-01-13 to 18-01-13 | 1. 220KV DC system voltage have been checked w.r.t. (+ Ve) to earth=136V, (-Ve) to Earth=89V, and to be rectified | Yes | Yes | NIL | NIL | NIL | NIL | Work in progress |
| | | | | | 2. 220V DC Source I & II mixing possibility is there and to be checked. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 3. Float charger of 220V system is not working in both chargers and presently chargers are working in Boost charging mode. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. Illumination in AC/DC room is very poor and same to be rectified | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. All 400KV and 220KV line relays are numerical except Main-I relay of 400KV Nagda-Indore, which has been installed and has to be connected. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 6. Separate event logger for S/S is not available and needs to be provided. | NIL | NIL | NIL | YES | NO | 4 months | |
| | | | | | 7. Directional E/F features is to be enabled on following feeders, 400KV Main-II Relay (GE D60), 400KV ISP Main-II (ABB REL 521) and 400KV Rajgarh I & II (Alstom make EPAC 3000 relay is to be replaced by SEL 311C relay and feature has to be enabled soon) | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 8. 25MVar 33KV Reactors installed on Tertiary winding of ICT-II and ICT-III are out of order since long time. | Yes | Yes | NIL | NIL | NIL | NIL | |

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|---------|---|--------------------|---|-------------------------------|---|---|-----|-----|---|-----|---------------|-----------|
| | | | | | | Yes | Yes | NIL | NIL | NIL | NIL | |
| 27 | 220KV S/S Ratlam | 220KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 06-05-13 to 07-05-13 | 1. Time synchronisation system is available with GPS system, its connectivity is made with all 220KV & 132KV DPR/Differential relays. Its connectivity with Bus Bar Relay B-90 is to be done. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 2. CT sec. core meant for back up protection is also used for Bus Bar protection for number of 220KV bays. For Bus Bar protection scheme PS class of CT Sec core is to be used. | Yes | Yes | NIL | NIL | NIL | NIL | |
| 28 | 400KV S/S Indore | 400KV | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 17-01-13 to 18-01-13 | 1. Tertiary Reactor of 315MVA Tr-I & II are not being taken in service due to high Tan delta values of Bushings, which should be replaced and reactors should be taken in to service. | NIL | NIL | NIL | YES | NO | Under Process | |
| | | | | | 2. On 400KV side Bus Bar relay make EE type FAC is electromagnetic type relay and it is very old and obsolete. Its spares are not available, This scheme may be replaced with the numerical Bus Bar protection scheme. | NIL | NIL | NIL | YES | NO | 4 months | |
| | | | | | 3. REF protection of 315MVA EMCO Tr-IV is kept under observation , which may be taken in to service. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 4. 220V DC Charger make Statecon is commissioned but not taken into service due to some problem. It should be rectified and taken into service. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 5. Additional DC distribution Board is available should be taken into service to separate the DC distribution to individual feeders. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 6. GPS time synchronisation system is available , Relays of 315MVA Transformers I, II & III are connected. All the relays of other feeders and Transformers are to be connected. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 7. Tripping/Closing time of 400KV Itarsi-I & II and Asoj-I & II CBs are not recorded. Same may be collected from PGCIL and update the record. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 8. Zone-III reach setting of 400KV Asoj-I & ii feeders are given as 120% of protected line (31.23 Ohm, Sec. value) Which is inadequate as backup zone protection. The time delay setting for Zone-III is given as 1000mSec. in all PGCIL feeders. Same may be reviewed in accordance with the CBIP guidelines and uniformity of settings adopted. | Yes | Yes | NIL | NIL | NIL | NIL | |
| | | | | | 9. No DC leakage observed, but mixing of Dc source- I & II detected. It should be rectified. | Yes | Yes | NIL | NIL | NIL | NIL | |
| 29 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | DPR relay setting of the 132 KV Jabalpur 1, Jabalpur 2 and Lakhnadon feeders to be reviewed | YES | YES | | | | | COMPLETED |
| 30 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | 220 V DC system having positive earth fault and mixing of the DC source 1 and 2 is observed. Periodical load test of the battery may be ensured. | YES | YES | | | | | COMPLETED |

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|---------|---|--------------------|--|-------------------------------|--|---|-----|--|---|----|--------|---|
| | | | | | | YES | NO | | YES | NO | | |
| 31 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | The 132 KV switchyard, Power House and equipment needs more attention towards its up keeping. | YES | YES | | | | | COMPLETED |
| 32 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | Records of the mock drill / trial of the fire fighting equipments and DG set are not available at Bargi Power Station. | YES | YES | | | | | COMPLETED |
| 33 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | All Existing Electromechanical / Electostatic Relays to be replaced with numerical relays. | | | | YES | NO | Dec-15 | Budgetary offer for replacing all electromechanical relay with Numerical Relay for supply with complete retrofitting job is being awaited. |
| 34 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | Fire Fighting system with CO2 Cylinders are available at power station but it is observed that it is in the manual mode. It may be in the auto mode. | | | | YES | NO | Dec-15 | The case of repairing and upgrading of CO2 system is under process. |
| 35 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | The Facility of DR/ SER is not available at the HPS Bargi. | | | | YES | NO | Dec-15 | The facility of DR/SER is provided in the offer of M/s ABB for retrofitting of numerical relay panel which is in the process. |
| 36 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | GPS Facilities is not available. | | | | YES | NO | Dec-15 | Preparation of Technical specification is under progress. |
| 37 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | 132 KV MOCB installed on 132 KV Jabalpur-1, Jabalpur-2, Lakhnadon, bus coupler bay and 20MVA transformer to be replaced with SF6 Circuit Breaker. | | | | YES | NO | Dec-15 | Budgetary offer for procurement of 132 KV SF6 breaker from M/s Crompton Greaves, ABB, Siemens etc. are awaited. |
| 38 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | LBB Relay not provided on the 132 KV Jabalpur-1, Jabalpur-2, Lakhnadon Feeders. | | | | YES | NO | Dec-15 | Provision for LBB relay on 132KV JBP-1, JBP-2, LKD feeders is being incorporated in fresh procurement case of numerical relays and shall be commissioned in future. |
| 39 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | 132 KV R phase CT of Bus Coupler (Bus-1) is not available. | | | | YES | NO | Dec-15 | CT WILL BE COMMISSIONED SHORTLY AS PER AVAILABILITY AND SHUTDOWN. |
| 40 | BARGI HPS | 132 KV SUB-STATION | Internal Protection Audit party comprising of representatives of State Utility and Power Grid | 22.04.13 & 23.04.13 | Bus Bar Protection is not in service. | | | | YES | NO | Dec-15 | PROCUREMENT OF BUS BAR PROTECTION IS UNDER PROCESS AND AT PRESENT BUDGETARY OFFER IS ASKED FROM FIRM. |
| 41 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility, NHDC & JP Bina | 22.04.13 & 23.04.13 | Carrier System is use for communication only, no carrier protection is provided. | | | | | | | NA |

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|---------|---|-------------|---|-------------------------------|---|---|--------------------|--|---|-----|------------|------------------------------------|
| | | | | | | YES | NO | | YES | NO | | |
| 42 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Positive side of 220 V DC sources - 1 is found earthed (Voltage between positive to earth is Zero and negative to earth is 240 V) Point at which DC leakage / earthling have developed may be detected and rectified at the earliest. | YES | YES | | | | | COMPLETED |
| 43 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | 220 V Battery charger - 2 and Battery set - 2 is very old and under replacement. | | | | YES | YES | | COMPLETED |
| 44 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Synchronizing trolley is available and working properly. | YES | YES | | | | | COMPLETED |
| 45 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | CTs star point earthling of 132 KV are checked and found no multiple earthlings in the system. | YES | YES | | | | | COMPLETED |
| 46 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Height of Live conductor in HV section from CB to wave trap in 132 KV Manasa bay is seems to be very less. Sufficient Ground clearance may be maintained for safety purpose. | YES | YES | | | | | COMPLETED |
| 47 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Operation of DG set is available in manual mode. Provision for auto mode operation may be provided so that DG set starts automatically in black - cut condition/exigency. | | | | YES | NO | 1-Mar-2016 | BUDGETARY OFFER IS BEING OBTAINED. |
| 48 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Auto Check synchronizing facility is not available, which should be provided for betterment of system. | | | | YES | NO | 1-Mar-2016 | BUDGETARY OFFER IS BEING OBTAINED. |
| 49 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Testing of DPR, Differential and other Relays. Along with corresponding CT & PT should be carried out in regular interval. | YES | PARTIALLY ATTENDED | | | | 1-Mar-2016 | |
| 50 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | DRs, SERs are not available for recording of system disturbances. | | | | YES | NO | 1-Mar-2016 | PROCUREMENT BEING CARRIED OUT |
| 51 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Back up O/c - E/F relays are not provided for all Generator Transformer. It should be provided at the earliest. | | | | YES | NO | 1-Mar-2016 | BUDGETARY OFFER IS BEING OBTAINED. |
| 52 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Almost all the relays provided for Generator, Generator Transformer (GT), Station Transformer of 20 MVA are electromagnetic type. These existing relay should be replaced with numerical relays for better reliability, sensitivity, faster response and compatibility with GPS system. | | | | YES | NO | 1-Mar-2016 | BUDGETARY OFFER IS BEING OBTAINED. |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|--|---|----|------------|---|
| | | | | | | | | | YES | NO | | |
| 53 | GANDHISAGAR HPS | 132 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.04.13 & 23.04.13 | Almost all relays (Distance protection, O/c, E/F relays) provided for 132 KV Feeders are electromagnetic type and required to be replaced by numerical relay for better reliability, sensitivity, faster response and compitbility with GPS system. | | | | YES | NO | 1-Mar-2016 | BUDGETARY OFFER IS BEING OBTAINED. |
| 54 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | PLCC ROOM - Dead Rodents odor was felt. | YES | YES | | | | | COMPLETED |
| 55 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | 220 KV Feeders - TMS of directional E/F is 0.1 second. It appears very low and to be reviewed in reference to fault MVA of Tons HPS. | YES | YES | | | | | COMPLETED |
| 56 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | 220 KV Feeders - Female contact of R & Y phases of bus-2 isolator of 220 KV Rewa feeder-2 is not available. Hence, it is not possible to put on this bus in case of any eventuality. | YES | YES | | | | | COMPLETED |
| 57 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RELAYS - Zone 3 time setting of 220 KV feeders is 600 mili seconds and it may be 700 milli seconds as per new instruction. | YES | YES | | | | | COMPLETED |
| 58 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | DG Set – Over current protection is out of service. | | | | Yes | No | Mar-16 | PROCUREMENT OF OVERCURRENT PROTECTION RELAY SHALL BE DONE UPTO 2015-16. |
| 59 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | 48 Volt DC System - Battery set is placed on the floor without putting insulator. | | | | Yes | No | Mar-16 | PROCUREMENT OF BATTERY SET SHALL BE DONE UPTO 2015-16 . |
| 60 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | PLCC ROOM - No PLCC cabinets for Rewa – 1, Rewa - 2 & Kotar directions. | | | | Yes | No | Mar-16 | PROCUREMENT OF MATERIAL INITIATED |
| 61 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Communication - Communication to 220 KV Kotar s/s is not available | | | | Yes | No | Mar-16 | |
| 62 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Communication - Communication to 220 KV Rewa s/s is not available | | | | Yes | No | Mar-16 | |
| 63 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Communication - Mode of communication with SLDC is very poor which may be improved by providing Landline phone in control room or by other suitable means. PLCC communication to Jabalpur is having much hauling. | | | | Yes | No | Mar-16 | |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|--|---|----|--|---|----|--------|--|
| | | | | | | | | | Yes | No | | |
| 64 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RTU - Active power transducer of 220 KV Rewa feeder-2 is found out. | | | | Yes | No | Mar-16 | PROCUREMENT UNDER PROCESS. |
| 65 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RTU - Alternate data channel to SLDC is not available. | | | | Yes | No | Mar-16 | PROCUREMENT OF MATERIAL INITIATED |
| 66 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | 220 KV Feeders - Carrier Protection & Auto re-closure feature has not been commissioned | | | | Yes | No | Mar-16 | PROCUREMENT OF NEW DUPLEX CONTROL AND RELAY PANEL UNDER PROCESS. |
| 67 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | 220 KV Feeders - 220 KV feeders' isolators with earth switch are not in working order. | | | | Yes | No | Mar-16 | ORDER PLACED AND WORK COMPLETED WITHIN SPECIFIED TIME UPTO 2015-16 |
| 68 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Transformer - MOLG of all the GTs are not working. | YES | No | | | | | RECIFIED IN UPCOMING AOH |
| 69 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Station Transformer - 33 KV lightning arrestor found disconnected. | | | | YES | No | Mar-16 | RECIFIED IN UPCOMING AOH |
| 70 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Generator Transformer - No mechanical tripping on existing 220 KV Gas Circuit Breaker of generator transformer and it is Single Pole Mechanism, it shall be Gang operated circuit breaker. | | | | YES | No | Mar-16 | PROCUREMENT OF MATERIAL INITIATED |
| 71 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Fire Protection – Generator fire protection is not in working order. | | | | YES | No | Mar-16 | ORDER PLACED TO FIRM AND WORK SHALL BE COMPLETED SHORTLY. |
| 72 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Governor - Unit 1 & 2 are on manual mode of governor operation. | | | | Yes | No | Mar-16 | 90% MATERIAL RECEIVED AT SITE AND WORK COMPLETED IN AOH OR IN SHUNT DOWN PERIOD. |
| 73 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RELAYS - Generator Protection & transformer protection is provided through electromechanical relays. It is to be provided with numeric relays. | | | | Yes | No | Mar-16 | PROCUREMENT UNDER PROCESS AND DELAY DUE TO LACK OF FUND. |
| 74 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RELAYS - The existing bus bar protection is un-commissioned and obsolete. It is to be provided through Numeric relays. | | | | Yes | No | Mar-16 | |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|--|---|--|--|---|----|--------------|---|
| | | | | | | | | | Yes | No | | |
| 75 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RELAYS - LBB protection is not commissioned on 220 KV feeders. | | | | Yes | No | UPTO 2015-16 | Order placed to M/s GE mumbai and LOI has been issued to the firm.work may be completed upto July-15. |
| 76 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RELAYS - Carrier protection is not available on all 220 KV feeders. | | | | Yes | No | Mar-16 | |
| 77 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RELAYS - 220 KV Bus coupler earth fault relay is out of order | | | | Yes | No | Mar-16 | PROCUREMENT UNDER PROCESS AND COMPLETED UPTO 2015-16 |
| 78 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | RELAYS - Some of the protection/ auxiliary relays are not having cover to prevent from dust, moisture and water etc. | | | | Yes | No | Mar-16 | PROCUREMENT UNDER PROCESS AND COMPLETED UPTO 2015-16 |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|--|---|----|--|---|-----|--------|---|
| | | | | | | YES | NO | | Yes | No | | |
| 79 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Earth Resistance – Earth Resistance record has not produced for 220/33 KV switch yard & electronic earthing of DAVR. | YES | NO | | | | | DONE IN UPCOMING AOH |
| 80 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | GPS Time Synchronizer was not available. | | | | Yes | No | Mar-16 | PROCUREMENT UNDER PROCESS. |
| 81 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Sequence Event Recorder was not available. | | | | Yes | No | Mar-16 | |
| 82 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Disturbance Recorder was not available | | | | Yes | No | Mar-16 | |
| 83 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Diagnostic Station was not available. | | | | Yes | No | Mar-16 | |
| 84 | TONS HPS | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | The condition of emergency lighting at various floors and control locations is poor. | | | | Yes | No | Mar-16 | MATERIAL RECEIVED AND WORK COMPLETED SHORTLY |
| 85 | ATPS#5 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Hathway make GPS time synchronising system is provided but connected on 220 KV Birsinghpur-3 & Sidhi feeders only, all other relays of feeders & transformers are to be connected. | | | | Yes | YES | | COMPLETED |
| 86 | ATPS#5 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | REF protection not provided on 220/132 kv ICTs, it is suggested to provide the same. | | | | | | | NOT REQUIRED DUE TO SHIFTING OF 132 KV SWITCHYARD |
| 87 | ATPS#5 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | ASEA make 132 kv MOCBs are in service,which is very old and inaqueate as per the increased fault MVA of the site.It is suggested to replace same | | | | | | | NOT REQUIRED DUE TO SHIFTING OF 132 KV SWITCHYARD |
| 88 | ATPS#5 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | 220 kv static Bus Bar Protection scheme make ABB, type RADSS is available at site since 2000, but awaited for commissioning. | | | | Yes | No | 15-16 | Order placed to M/s GE mumbai and LOI has been issued to the firm.work may be completed upto July-15. |
| 89 | ATPS#5 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | LBB Protection is not provided for any element and it is suggested to take in service at earliest | | | | Yes | No | 15-16 | |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|--|---|----|--------|---|
| | | | | | | | | | | | | |
| 90 | ATPS#5 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | Auto Reclosure feature is provided for 220 KV Birshingpur - 3, Jabalpur I & II and Sidhi feeders only. For other 220 KV feeders Auto Reclose facility is available but not be commissioned due to non availability of PLCC protection couplers. | | | | Yes | No | Mar-16 | DELAY IN COMPLETION DUE TO NON-AVALIABILITY OF PLCC PANELS FROM MPPTCL FOR OTHER END |
| 91 | ATPS#5 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | One set of 600 AH battery set is provided for switch yard, which is very old and in poor condition its need early replacement.Battery Capacity test could not be done due to some opertional problem. | | | | Yes | No | Mar-16 | PROCUREMENT OF BATTERY IS IN UNDER PROGRESS, NIT HAS BEEN PUBLISHED |
| 92 | ATPS#5 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 11.02.13 & 12.02.13 | A stand by DC supply is available at switchyard to power plant,DC load of 220 kv panels are running on this supply.It is recommended by committee to provide separate DC supply arrangement for power plant and switchyard. | | | | Yes | No | Mar-16 | SHALL BE DONE SHORTLY |
| 93 | SGTPS 1 TO 4 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | Partial DC leakage observed, it is advised to rectify the same. | Yes | YES | | | | | COMPLETED |
| 94 | SGTPS 1 TO 4 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | 220 KV Bus Bar Protection is available but not in service due to some problems | | | | Yes | No | Apr-16 | Order placed to M/s GE mumbai and LOI has been issued to the firm.work may be completed upto July-15. |
| 95 | SGTPS 1 TO 4 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | LBB Protection relay are available but protection are not provided for any element and it is suggested to put the same in service. | | | | Yes | No | Apr-16 | |
| 96 | SGTPS 1 TO 4 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | ESR/DR is not installed but it available in numerical relays provided in 220 kv pali interconnector-I and 220 kv Sukha feeders only. | | | | Yes | No | Mar-16 | PROCUREMENT INITIATED AND SHALL BE COMPLETED SHORTLY. |
| 97 | SGTPS 1 TO 4 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | Auto reclose facility not provided on any 220 kv feeders. It is intimated that protection couplers are not available and it is suggested to provide the same. | | | | Yes | No | Mar-16 | PROCUREMENT INTIATED AND SHALL BE COMPLETED SHORTLY. |
| 98 | SGTPS 1 TO 4 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | GPS based time synchronisation facility is not available. It is suggested to provide the same. | | | | Yes | No | Mar-16 | PROCUREMENT SHALL BE INTIATED . |
| 99 | SGTPS 1 TO 4 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | A separate source for 220 kv dc supply is provided for electrical control room and 220 kv switchyard. This battery set is very old, commissioned 1991 needs replacement. | | | | Yes | No | Mar-16 | |
| 100 | SGTPS 1 TO 4 | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | Emulsifier system is provided on GT and UAT for Fire protection. Same is operate manually. | Yes | No | | | | Mar-16 | SYSTEM IS WORKING IN MANUAL MODE AND AUTO OPERATIOM WILL BE STARTED SHORTLY. |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|--|---|----|--------|--|
| | | | | | | | | | | | | |
| 101 | SGTPS # 5 | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | Static Bus Bar Protection scheme is provided on 400 kV bus make ABB Type-RADHA. A numerical Bus-Bar protection scheme may be provided as suggested by the committee. | | | | Yes | No | Mar-16 | PROCUREMENT INTIATED. |
| 102 | SGTPS # 5 | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | DG set available in power plant and it is suggested by the committee to extend AC supply as stand by to 400 kV control room and switchyard in case of emergency. | | | | Yes | No | Mar-16 | WILL BE DONE SHORTLY . |
| 103 | SGTPS # 5 | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | Spare unit of single phase ICT is not ready to use, it should be attened and kept in ready condition in case of emergency. | | | | Yes | No | Mar-16 | WORK SHALL BE COMPLETE WITHIN 2 MONTHS |
| 104 | SGTPS # 5 | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | High voltage problem are reported and it is suggested to provide bus reactor or line reactor on 400 kv BRS-Damoh line I & II at BRS end. | | | | Yes | No | | NOT POSSIBLE AS AVAILIABLE SPACE HAS ALREADY BEEN UTILISED BY M/s PGCIL. |
| 105 | SGTPS # 5 | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 13.02.13 & 14.02.13 | 400 KV BRS - BAICO and BRS-Vandana Power (KORBA) bays belongs to PGCIL | | | | | | | UNDER SCOPE OF M/s PGCIL. |
| 106 | STPS PH-I | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | No GPS in control room and it is necessary for the root cause analysis of the disturbance occurred in the grid | | | | Yes | No | Mar-16 | NOT APPLICABLE BECAUSE ALL 5 UNITS OF PH-I HAS ALREADY RETIRED. |
| 107 | STPS PH-I | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | In the protection scheme electromechanical and static relay are in use but as per present grid norms availability of numerical relay is required for fault analysis and event recorder. | | | | Yes | No | Mar-16 | |
| 108 | STPS PH-I | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Fire protection system of transformers are out of order and suitability of nitrogen injection fire protection system may be explored. | | | | Yes | No | Mar-16 | |
| 109 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | No GPS in control room and it is necessary for the root cause analysis of the disturbance occurred in the grid | | | | Yes | No | Mar-16 | TENDER FOR PROCUREMENT IS STARTED AND ITS DUE DATE 30.08.14. |
| 110 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Some of the cells of unit no.7 are bulged in plante type battery set which resulting in breaking of the container and lid therfore it should be replaced at the earliest. | Yes | Yes | | Yes | No | Mar-16 | Order has been placed to M/S Exide industries vide no. - 08-004/P&W/EMD-II/PE-297/PO-568/462 dtd. 21.06.14 |
| 111 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Some of the cell are bypassed due to bulging problem thereby reducing the available capacity of the bank. | Yes | Yes | | Yes | No | Mar-16 | |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|---|---|-----|--------|---|----|--------|--|
| | | | | | | Yes | No | Mar-16 | Yes | No | Mar-16 | |
| 112 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Battery bank of unit 6& 7 were commissioned in the year 2004 & 2001 respectively.As per CEA circular fair life of battery is 5 years only therefore suitable action for their replacement is to be initiated at the earliest. | Yes | Yes | | Yes | No | Mar-16 | |
| 113 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | No alarm for DC E/F is provided in the chargers. | Yes | Yes | | | | | DONE DURING AOH OF UNITS |
| 114 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Capacity test has not been conducted recommended to do onces in a year. | Yes | Yes | | Yes | No | Mar-16 | ORDER PLACED TO M/S EXIDE INDUSTRIES |
| 115 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | In the protection scheme electromechanical and static relay are in use but as per present grid norms availabilty of numerical relay is required for fault analysis and event recorder. | | | | Yes | No | Mar-16 | Order for numerical generator protection relay for unit no. 6 & unit no. 7 has been placed and its should be replaced shortly. |
| 116 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Pole slip protection is not available so it shall be provided. | | | | Yes | No | Mar-16 | NOT APPLICABLE |
| 117 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Auto reclosure/Disturbance Recorder/Event Logger/SER all are not available. | | | | Yes | No | Mar-16 | PROCUREMENT INTIATED . |
| 118 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Carrier Protection is not available in 220 kV switchyard. | | | | Yes | No | Mar-16 | WILL BE DONE SHORTLY . |
| 119 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Earth Mettaling is not visible in 220 kV switchyard | | | | Yes | No | Mar-16 | WILL BE DONE SHORTLY . |
| 120 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Mulsi Fire protection of the transformer is out of order, suitability of Nitrogen injection may be explored | | | | Yes | No | Mar-16 | WILL BE DONE SHORTLY . |
| 121 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Suitability of short circuit breaking capacity of circuit bkr & short time current capacity of CT's shall be reviewed in respect of existing fault level's | | | | Yes | No | Mar-16 | WILL BE DONE SHORTLY . |

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| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|--|---|-----|--|---|----|--------|---|
| | | | | | | YES | NO | | YES | NO | | |
| 122 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Scaling is observed on the terminal of some of the batteries. | YES | YES | | | | | COMPLETED |
| 123 | STPS PH-II | 220 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | L&T make switchgear indicating lamp assembly is missing and they are vacant i.e whole are uncovered. | YES | YES | | | | | COMPLETED |
| 124 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | 220v dc battery source - no alarm for dc e/f is provided in the chargers. | YES | YES | | | | | COMPLETED |
| 125 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | 220v dc battery source - capacity test has been conducted in the year 2011. recommended to do the capacity test once in a year. | YES | YES | | | | | COMPLETED |
| 126 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | 220 V DC battery source - records indicated the voltage measurement of individual cells with the charger on condition. This readings are to be taken with charger off condition also. | YES | YES | | | | | COMPLETED |
| 127 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | 220 V DC battery source - Scaling is observed on the terminals of some of the batteries. Also the general cleanliness of the batteries and battery room need improvement. | YES | YES | | | | | COMPLETED |
| 128 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | ISP Feeder - Over voltage stage i and stage ii protection has been provided through separate rxege-21 relays. | YES | YES | | | | | COMPLETED |
| 129 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | ISP Feeder - over voltage stage ii setting has been adopted as 130% . this should be reviewed. | YES | YES | | | | | COMPLETED |
| 130 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | No gps in 400kv control room . | | | | Yes | No | Mar-16 | TENDER OPENED AND CASE IS UNDER PROCESS. |
| 131 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | 220 V DC battery source - 216 V Dc battery source of unit# 8 of 1200ah capacity - It was commissioned in the year 2004. As per cea circular the revised fair life is 5 years only. Suitable action for their replacement is to be initiated at the earliest. | | | | Yes | No | | ACCORDING TO CE(Engg.) JABALPUR AS PER IEEE 450-1987,THE RECOMMEND PRACTICE TO REPLACE BATTERY IS BASED ON C-10 TEST AND NOT A TIME BOUND AND C-10 TEST FOUND SATISFACTORILY IN AUG-13 & THE SAME WILL BE PERIODICALLY REPEATED IN AOH. |
| 132 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | 220 V Dc battery source - 216 V DC battery source of unit# 9 of 1200ah capacity - It was commissioned in the year 2004. As per cea circular the revised fair life is 5 years only. Suitable action for their replacement is to be initiated at the earliest. | | | | Yes | No | | |

Name of Utility - MADHYA PRADESH POWER TRANSMISSION CO. LTD JABALPUR

| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|--|---|-----|---------------|---|-----|---------|--|
| | | | | | | | | | Yes | No | | |
| 133 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | 220 V DC battery source - 216 V DC battery source for station of 1200ah capacity - It was commissioned in the year 2009. As per cea circular the revised fair life in 5 years only. | | | | Yes | No | | ITS C-10 TEST DONE IN NEXT AVAILABLE OPPORTUNITY. |
| 134 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | ISP Feeder - Reverse zone is not provided is rel 521 relay. The zone calculations may be revised. | | | | Yes | No | Mar-16 | ENQUIRY ISSUED TO OEM FOR TESTING AND REVIEW OF RELAY SEETING.OFFER STILL AWAITED. |
| 135 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | ISP Feeder - Over voltage protection has not been enabled in rel521 numerical relay. | | | | Yes | No | Mar-16 | ENQUIRY ISSUED TO OEM FOR TESTING AND REVIEW OF RELAY SEETING.OFFER STILL AWAITED.OVERVOLTAGE SEETING STAGE-1 & STAGE-II HAVE BEEN PROVIDED THROUGH SEPARATE RXEG-21 |
| 136 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Reactor - 63 MVARs bus reactor no. 1 is out since 24.05.2005. | | | | Yes | No | JUNE'15 | LOI HAS BEEN ISSUED TO M/S ALSTOM T&D INDIA LTD VIDE 08-004/P&W/STPS/EMD-3/WT-329/TENDER-1077/LOA/1750 DTD.03/11/14 |
| 137 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Reactor - new reactor is available. it should be commissioned early. | | | | Yes | No | JUNE'15 | |
| 138 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Fire protection of transformer - mulsifire type fire protection system is out of order. | | | | Yes | No | Mar-16 | WAITING FOR RECEIPT OF OFFER |
| 139 | STPS PH-III | 400 | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 12.03.13 & 13.03.13 | Fire protection of transformer - suitable of nitrogen injection fire protection system may be explored. | | | | Yes | No | Mar-16 | WAITING FOR RECEIPT OF OFFER |
| 140 | ISP | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.02.2013 & 23.02.2013 | Time delay setting for Zone-3 is given as 500ms, which is very low and it should be revised as per CBIP recommendation or in co-ordination with MPPTCL setting for Zone-3 that is 700ms. | | YES | | N/A | N/A | N/A | Time delay settings changed from 500ms to 700ms on 20.09.2013. |
| 141 | ISP | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.02.2013 & 23.02.2013 | Thermovision survey/thermal scanning is being done annually, it should be done monthly. | | No | Under Process | N/A | N/A | N/A | Case for thermovision scanning on monthly basis is under tendering stage. |
| 142 | ISP | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.02.2013 & 23.02.2013 | As per latest guidelines directionla Eart fault Protection is to be provided on 400 KV Lines. It can be provided through existin numirical DPRs. It is suggested to provide the same | | No | Under Process | N/A | N/A | N/A | It has been planned to provide the directional earth fault protection on 400 KV line in near future to be executed by OEM M/s ABB Ltd. |
| 143 | ISP | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 22.02.2013 & 23.02.2013 | Partial DC leakage observed in battery sets of power plant. It is suggested to rectify the same. | | YES | | N/A | N/A | N/A | Problem rectified. |

Name of Utility - MADHYA PRADESH POWER TRANSMISSION CO. LTD JABALPUR

| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark | |
|---------|---|-------------|---|-------------------------------|--|---|-----|---|---|----|----|---|--|
| | | | | | | Yes | Yes | NA | NA | NA | NA | | |
| 153 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 1)UAT 1&2 for unit 1 still not commissioned | Yes | Yes | NA | NA | NA | NA | All the UAT of Unit 1&2 have been commissioned (Complied) | |
| 154 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 2) GPS system not commissioned | Yes | Yes | NA | NA | NA | NA | GPS system of whole station commissioned (Complied) | |
| 155 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 3) 2no. Of High Mast tower installed near 400KV transfer bus in the switchyard | No | YES | NA | NA | NA | NA | Both the high mast has been shifted to out side corners of the Switchyard (Complied) | |
| 156 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 4)DR&ER is provided in SCADA system. | Yes | yes | NA | NA | NA | NA | It is available in our SCADA system (Complied) | |
| 157 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 5)Battery cell voltage need to be recorded with respective charger in OFF condition. | Yes | yes | NA | NA | NA | NA | Battery cell voltage is now being recorded respective to charger in off condition. (Complied) | |
| 158 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 6)Directinal E/F relay setting 1 sec. for PGCIL 1.2 Sec.for MPPTCL line is provided .This is on higher side,to be reviewed& revise | Yes | | Comments from our consultant M/S TCE is given | NA | NA | NA | NA | Answer from our consultant M/S TCE : Directional e/f is provided to protect the system from high impedance line faults where fault currents are low. So 1 sec operating time is sufficient and can be used for both the lines. Decrease in the operating time may cause it to interfere with 3rd zone time settings. (Setting is in order. Hence complied) |
| 159 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 7)Over voltage setting for 400kv PGCIL&MPPTCL line are not as per CBIP recomendetion(CBIP REV 274). | Yes | | Comments from our consultant M/S TCE is given | NA | NA | NA | NA | Our consultant TCE's reply :Please note that an instantaneous overvoltage setting of 130% phase to phase can be used. As per standard practice lines are capable of withstanding 150% of highest system voltage at power frequency for 1 minute. So above settings are ok. (Setting is in order. Hence complied) |
| 160 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 8)GT&ST fifth harmonics blocking is done for 20%. This may be studies & revised. | Yes | | Comments from our consultant M/S TCE is given | NA | NA | NA | NA | Reply from consultant TCE ;As per recommendation from relay manuals, setting of 15 to 30 % is used for fifth harmonic blocking. As per our standard 20% is used fifth harmonic blocking. (Setting is in order. Hence complied) |
| 161 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 9)It is observed that for ganretor protection under frequency relay trip setting 48.5Hz for 5sec.& over frequency relay trip setting 51.0Hz for 5sec. is taken,the same may be reviewed. | Yes | | Comments from our consultant M/S TCE is given | NA | NA | NA | NA | OUR consultant reply Frequency protection is used mainly for alarm and as per our practice a time delay of 5 sec is adequate. (Setting is in order. Hence complied) |

Name of Utility - MADHYA PRADESH POWER TRANSMISSION CO. LTD JABALPUR

| Sl. No. | Name of Sub-Station identified for Protection Audit | S/S Voltage | Name of Protection Audit Agency | Date of which Audit Conducted | Observation of Protection Audit | Deficiencies that can be corrected without procurement (Category-A) | | | Deficiencies involving procurement (Category-B) | | | Remark |
|---------|---|-------------|---|-------------------------------|--|---|---|----|---|----|----|--|
| | | | | | | Yes | Comments from our consultant M/S TCE is given | NA | NA | NA | NA | |
| 162 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 10)In turn protection has not been provided,through it is recommended for Generator more than 100 MVA. | Yes | Comments from our consultant M/S TCE is given | NA | NA | NA | NA | Our consultant TCE's reply ;As per our standard practice, inter-turn protection is provided only when specifically recommended by the manufacturer. (It is in order. Hence complied) |
| 163 | Jaypee Bina Thermal Power Plant | 400 KV | Internal Protection Audit party comprising of representatives of State Utility , NHDC & JP Bina | 14.02.2013 & 15.02.2013 | 11)Periodical testing of relays & yard equipment must be done. | Yes | | | NA | NA | NA | Periodical testing of relay & yard equipments . (It will be done by this year) |

FORMAT FOR PROTECTION AUDIT DEFICIENCIES/OBSERVATIONS COMPLIANCE

| Power Grid Corporation of India Ltd., Region -WR-I | | | | | | | | | | | | |
|--|------------------|---|-------------------------------|--|---|-------------------------|-------------------------|--|-------------------------|-------------------------|--|----------|
| Name of Utility | | | | | | | | | | | | |
| Name of S/S identified for protection Audit | S/S voltage (kV) | Name of Third Party Protection Audit Agency | Date on which Audit Conducted | Observations of protection Audit | Deficiencies that can be corrected without procuremnet (Category A) | | | Deficiencies that can be corrected with procuremnet (Category B) | | | If not tentative date for protection audit | Remarks |
| | | | | | Yes/No | Whether attended Yes/No | If not attended, reason | Yes/No | Whether attended Yes/No | If not attended, reason | | |
| Seoni | 765 | PGCIL WR-II, WRLDC | 12.01.13 | NIL | NA | NA | NA | NA | NA | NA | NA | |
| Wardha | 765 | MSETCL, WRLDC | 17.04.13 | For any modified relay settings revision received from corporate / RHQ should be maintained in separate register. | Yes | Yes | NA | NA | NA | NA | NA | Attended |
| Bilaspur | 765 | MPEB, WRLDC | 15.04.13 | 220 V Battery Charger Voltage on higher side. | Yes | Yes | NA | NA | NA | NA | NA | Attended |
| Pune | 400 | PGCIL WR-II, WRLDC | 28.01.13 | 400Kv Main-II Busbar protection out of service. | Yes | Yes | NA | NA | NA | NA | NA | |
| Solapur | 400 | MSETCL,WRLDC | 17.04.13 | NIL | NA | NA | NA | NA | NA | NA | NA | |
| Parli | 400 | MSETCL,WRLDC | 16.04.13 | Broken conductor alarm may be adopted in MSETCL Parli lines. | Yes | Yes | NA | NA | NA | NA | NA | Attended |
| Bhadrawati | 400 | PGCIL WR-II, WRLDC | 22.01.13 | NIL | NA | NA | NA | NA | NA | NA | NA | |
| Bhatapara | 400 | PGCIL WR-II, WRLDC | 04.02.13 | 1 nos. Display of REL 670 not working | Yes | Yes | NA | NA | NA | NA | NA | Attended |
| Raigarh | 400 | PGCIL ER-II, WRLDC | 07.12.12 | a)390 KV LA of Bus Reactor to be replaced by 336KV. b)Repairs of NRV of Jockey pump carried out. | Yes | Yes | NA | NA | NA | NA | NA | Attended |
| Mapusa | 400 | MSETCL, WRLDC | 17.04.13 | NIL | NA | NA | NA | NA | NA | NA | NA | |
| Boisar | 400 | PGCIL WR-II, WRLDC | 09.04.13 | NIL | NA | NA | NA | NA | NA | NA | NA | |
| Raipur | 400 | PGCIL WR-II, WRLDC | 06.02.13 | a)Some of ICT/Reactor protection are staic type may be replaced by Numerical relay. b)In 400KV Wardha-1 & 2 Main2 relay T-cord time found 0.04sec and reverse zone time found 1.0 sec. | Yes | Yes | NA | NA | NA | NA | NA | Attended |

Summary Sheet of Protection Audit from WRTS II

| Voltage Level | Total no of S/s in Region - (A) | No of S/s identified for Protection Audit (B) | | No of S/s yet to be audited (C) | Target Date of Completion of audit (D) | No of S/s where deficiencies detected (E) | |
|---------------------------|---|--|---|---|--|---|--|
| 132kV wherever applicable | Not Applicable | | | | | | |
| 220kV | Not Applicable | | | | | | |
| 400kV | 11 | 11 | | All completed | All completed | 1 | |
| 765kV | 3 | 3 | | All completed | All completed | 3 | |
| HVDC S/s | Not Applicable | | | | | | |
| Total | 14 | 14 | | All completed | All completed | 4 | |
| Voltage Level | Action Plan (on observation of third party protection audit) finalization date / target date for finalizing plan (F) | Detail of S/s where no procurement is required for removal of deficiencies (G) | | Detail of S/s where procurement is required (H) | | Reason / Remraks for rectification of deficiencies requiring period of more than one year (I) | Cost estimates for removal of deficiencies (J) |
| | | No of S/s | target date of removal of deficiencies | No of S/s | target date of removal of deficiencies | | |
| 132kV wherever applicable | Not Applicable | | | | | | |
| 220kV | Not Applicable | | | | | | |
| 400kV | <p>1. Shujalpur S/S - Rectification of DG Set Auto Starting completed</p> <p>2. Dehgam S/s: - Non working of Main II Relay of Ranchodpura 2 Line of GETCO and Non Time Synchronisation of Relays of all the GETCO Lines</p> | 2 | <p>1. Shujalpur S/S - Rectification completed</p> <p>2. Dehgam S/s: - Non working of Relay of Ranchodpura has been resolved. Non time synchronisation issue taken up with M/s GETCO</p> | Not Applicable | | | |
| 765kV | <p>1. Bina S/s: - Earth Resistance was measured during Peak Summer as mentioned in the Protection Audit Report</p> <p>2. Satna S/s: - DG Set Auto Start problem has been rectified</p> <p>3. Gwalior S/s: - Commissioning of PLCC in 220kV Lines has been taken up with M/s MPPTCL</p> | 3 | <p>1. For Satna & Bina S/s: - Matter resolved</p> <p>2. For Gwalior S/s: - PLCC has been commissioned by MPPTCL</p> | | | | |
| HVDC S/s | Not Applicable | | | | | | |
| Total | 5 | --- | | Not Applicable | | | |

Name of the Organization: NTPC Limited-WR stations

| Sr.No | Deficiency Observed during Basic Protection Audit | Action taken / proposed to be taken | Time Schedule |
|---|--|---|---------------------|
| Name of the Sub-station / Switchyard: Vindhyachal STPP | | | |
| 1. | Replacement of balance Static distance protection relays, with Numerical relays, in line with Gazette notification of GOI for 400 kV Satna 1 & 2 lines. | Completed | Complied-B category |
| 2. | 63 MVAR Bus reactor needs to be taken into service. | Put in service | Complied-B category |
| 3. | Main-I and Main-II Distance protection Schemes for all feeders need to be different make/characteristic for 400 kV Sasan, Mahan, and Satna-III & IV lines. | Being adopted. | Complied-B category |
| 4. | Earth fault in 220 V switchyard DC system to be attended. | Ongoing routine activity | Complied-A category |
| Name of the Sub-station / Switchyard: Korba STPP | | | |
| 1. | Over voltage relay: Drop off to Pick up ratio is not explicitly available in Micom relays. | Minimum Drop off / pick up ratio of 95% is available in MiCom relay and it is in order as far as over voltage protection is concerned. With a very high reset/operate ratio, chattering phenomena may be observed in relay. | Complied-A category |
| 2. | Power swing blocking is enabled for Z2, Z3 and Z4. However de-blocking timer is set at 2 sec. The same may be reviewed. | Power swing blocking logic has to be universally decided across the grid. De-block timer of 2 sec has been adopted in all NTPC stations and is in line with NRPC / ERPC recommended setting guideline. | Complied-A category |
| 3. | Auto re-close relay reclaim timer not uniform for all lines. Stage-I lines is having 10 secs and the same is 25 secs for stage-II lines. This may be reviewed. | Reclaim time of 25secs to be adopted for all lines as per NTPC practice. | Complied-A category |

| Sr.No | Deficiency Observed during Basic Protection Audit | Action taken / proposed to be taken | Time Schedule |
|---|---|---|---------------------|
| 4. | Zone 2 time delay is different for different lines (300ms and 400ms). The same may be reviewed. | As per NTPC practice, Zone-2 time delay of 400ms is being adopted & it is 500ms in case of long lines followed by short lines. The same to be adopted. | Complied-A category |
| Name of the Sub-station / Switchyard: Sipat STPP | | | |
| 1. | Time Synchronization: All numerical relays except 5 nos relays of 765KV and 4 nos of relays of 400KV are time synchronized. | Taken up with OEM. Only 01 relay could be synchronized with GPS successfully. | Complied-B category |
| 2. | Time setting of both Stage-I and Stage-2 are same in all 765KV and 400KV LBB relays. | The setting has been reviewed and found in order. | Complied-A category |
| 3. | Over voltage relay: Drop off to Pick up ratio is not explicitly available in Micom relays. | Minimum Drop off / pick up ratio of 95% is available in MiCom relay and it is in order as far as over voltage protection is concerned. With a very high reset/operate ratio, chattering phenomena may be observed in relay. | Complied-A category |
| 4. | Power swing blocking is enabled for Z2, Z3 and Z4. However de-blocking timer is set at 2 sec. The same may be reviewed. | Power swing blocking logic has to be universally decided across the grid. De-block timer of 2 sec has been adopted in all NTPC stations and is in line with NRPC / ERPC recommended setting guideline. | Complied-A category |
| Name of the Sub-station / Switchyard: Jhanor Gandhar GPS | | | |
| 1. | Replacement of existing static relays for line protection with Numerical distance relays. | PO placed. | Complied-B category |

FORMAT -2 (REVIEW OF ZONE - 3 PHILOSOPHY)

Recommendation 9.1.2: Till protection audit is taken up, there is a need to take immediate review of zone 3 philosophy in particular. Techniques are available to modify characteristics of the relay so that it can distinguish between load encroachment and faults. These techniques and other alternatives should be explored immediately. Action : RPCs, CTU, STUs.:

| WRPC | Total No. of S/S at 220 kV & above (132 KV & above in NER states, J&K, Uttarakhand, HP, Sikkims, etc) | | | | No. of sub-stations covered at each voltage level. | | | | No. of S/S where revised Z-III setting have been implemented. | | | | Month and year by when revised Z-III settings would be implemented at remaining sub-station. | | | |
|------------|---|-----|-----|-------|--|-----|-----|-------|---|-----|-----|-------|--|-----|-----|-------|
| | 765 | 400 | 220 | Total | 765 | 400 | 220 | Total | 765 | 400 | 220 | Total | 765 | 400 | 220 | Total |
| Maha | | 24 | 186 | 210 | | 24 | 186 | 210 | | 24 | 186 | 210 | | | | |
| Guj | | 11 | 81 | 92 | | 11 | 81 | 92 | | 11 | 81 | 92 | | | | NA |
| CG | | 1 | 18 | 19 | | 1 | 18 | 19 | | 1 | 18 | 19 | | | | |
| MP gen | | 3 | 5 | 8 | | 3 | 5 | 8 | | 3 | 5 | 8 | | | | NA |
| MP tran+JP | | 9+1 | 62 | 72 | | 9+1 | 62 | 72 | | 9+1 | 62 | 72 | | | | NA |
| OSP | | | 1 | | | | 1 | | | | 1 | | | | | |
| ISP | | 1 | | | | 1 | | | | 1 | | | | | | NA |
| WR-I (PG) | 3 | 8 | 0 | | 3 | 8 | 0 | | 3 | 8 | 0 | | | | | NA |
| WR-II (PG) | 3 | 11 | | 14 | 3 | 11 | | 14 | 3 | 11 | | 14 | | | | NA |
| (NTPC) | | 3 | 1 | 4 | | 3 | 1 | 4 | | 3 | 1 | 4 | | | | |

List of NI PMUs installed under WRLDC pilot project

| S.No | Sub-station owner | Sub-station | Date of Commissioning | CT Connection (Feeders) | PT Connection |
|------|-------------------|---------------|-----------------------|--------------------------|---------------|
| 1 | WRTS-I | Boisar | 10.04.2013 | Phadke, Tarapur-2 | Bus-1 |
| 2 | WRTS-I | Bhadravathi | 16.04.2013 | Raipur-2, Raipur-3 | Bus-1 |
| 3 | WRTS-I | Solapur 400kV | 18.04.2013 | Kolhaur-1, Parli-1 | Bus-1 |
| 4 | NTPC | Korba | 10.09.2013 | Bhatupara, Generator-6 | Bus-2 |
| 5 | NTPC | Vindhyachal | 18.09.2013 | Jabalpur-1, Korba-1 | Bus-1 |
| 6 | WRTS-I | Solapur 765kV | 26.12.2013 | Raichur- 1 & 2 | Bus-1 |
| 7 | WRTS-II | Dehgam | 13.04.2013 | Gandhar-2, Pirana-2 | Bus-1 |
| 8 | WRTS-II | Itarsi | 20.04.2013 | Jabalpur-2, Indore-2 | Bus-1 |
| 9 | WRTS-II | Satna | 23.04.2013 | Bina-3, Vindychal-3 | Bus-1 |
| 10 | MPPTCL | Bina MP | 13.09.2013 | PGCIL-1, Bhopal-1 | Bus-1 |
| 11 | CGPL | CGPL Mundra | 06.09.2013 | Limbdi-2, GT-3 | Bus-2 |

List of SEL PMUs installed under NLDC pilot project

| S.No | Sub-station owner | Sub-station | Date of | CT Connection (Feeders) | PT Connection |
|------|-------------------|-------------|------------|--------------------------|---------------|
| 1 | WRTS-II | Jabalpur | 02.11.2012 | Itarsi-2, Vindychal-4 | Bus-1, Bus-2 |
| 2 | WRTS-I | Raipur | 08.11.2012 | Korba-3, Raigarh-1 | Bus-1, Bus-2 |
| 3 | GETCO | Asoj | 1.11.2013 | Indore-1 | Bus-1 |
| 4 | MSETCL | Kalwa | 9.11.2013 | Padghe-II, Kharghar | Bus-1, Bus-2 |

List of Demo GE PMUs

| S.No | Sub-station owner | Sub-station | CT Connection | PT Connection |
|------|-------------------|-------------|---------------|---------------|
| 1 | WRTS-II | Itarsi | Jabalpur-1 | Bus-1 |
| 2 | WRTS-II | Jabalpur | Itarsi-1 | Bus-1 |

List of IPP PMUs

| S.No | Sub-station owner | Sub-station | CT Connection (Feeders) | PT Connection |
|------|-------------------|----------------------|---------------------------|---------------|
| 1 | APL | APL Mundra (Siemens) | Dehgam-2, Hadala | Bus-1 |
| 2 | WRTS-I | Dhariwal (NI) | Bhadrawathi-2, Dhariwal-2 | Bus-1 |
| 3 | TRN | TRN | Tamnar-1, Tamnar-2 | Bus 1 , Bus 2 |

Maharastra

| S. NO. | Voltage (kV) | PMU Location |
|--------|--------------|--------------|
| 1 | 400 | Chandrapur |
| 2 | 400 | Bhusawal |
| 3 | 400 | New Koyna |
| 4 | 400 | Padghe |
| 5 | 400 | Dhule |
| 6 | 400 | Kalwa |
| 7 | 400 | Kolapur |
| 8 | 400 | Aurangabad |
| 9 | 400 | Lamboti |
| 10 | 400 | Lonikand |
| 11 | 400 | Girwali |
| 12 | 220 | Trombay |
| 13 | 220 | Eklahare |
| 14 | 220 | Boisar |

| WR II | | |
|-------------|----------|---|
| No. of PMUs | Location | No. of units functional & Time Synchronised |
| 1 | Vapi | 1 |

Format - 4 (Enabling UFR and df/dt relay)

Action: STUs, RPCs, Posoco, Time frame: immediate

| RPC (State) | State wise details of UFR (as on date) | | | | | | |
|--|---|--------------------------------|-----------------------------------|--|--|---|------------------------------|
| | Total No. of UFRs installed | No. of UFRs functional | No. of UFRs nonfunctional | action being taken to make them functional | month and year to complete the remedial action | Details of additional UFRs under implementation/planned | |
| | | | | | | No. | Target date of commissioning |
| Maha | 389 | 389 | 0 | | | | |
| Guj | 149 | 145 | 4 | OEM is contacted for repairing scheme | NA | TBD | TBD |
| CG | | | | | | | |
| MP+JP | 283+0 | 283+0 | 0 | | | | |
| OSP | 8 | 8 | 0 | | | | |
| ISP | 12 | 12 | 0 | | | | |
| WR-I (PG) | | | | | | | |
| WR-II (PG) | | | | | | | |
| WR-I (NTPC) | | | | | | | |
| WR-II (NTPC) | | | | | | | |
| RPC (State)State wise details of df/dt (as on date) | | | | | | | |
| | Total No. of df/dt relays installed | No. of df/dt relays functional | No. of df/dt relays nonfunctional | action being taken to make them functional | Month and year to complete the remedial action | Details of additional df/dt relays under implementation/planned | |
| | | | | | | No. | Target date of commissioning |
| Maha | 31 | 28 | 3 | | | | |
| Guj | 149 | 145 | 4 | OEM is contacted for repairing scheme | NA | TBD | TBD |
| CG | | | | | | | |
| MP+JP | 34+2 | 34+2 | 0 | | | | |
| OSP | 0 | 0 | 0 | | | | |
| ISP | 12 | 12 | 0 | | | | |
| WR-I (PG) | | | | | | | |
| WR-II (PG) | | | | | | | |
| WR-I (NTPC) | | | | | | | |
| WR-II (NTPC) | | | | | | | |
| POSO CO (Petition wise) | No. and details of petitions filed with CERC for non-compliance of various regulations, issued under the act, by the states | | | Brief of petition filed in CERC | | Status of Petition | |
| WRLDC | 22 | | | | | 22 | |
| Maha | | | | | | | |
| Guj | | | | | | | |
| CG | | | | | | | |
| MP | | | | | | | |
| WR-I (PG) | | | | | | | |
| WR-II (PG) | | | | | | | |
| WR-I (NTPC) | | | | | | | |
| WR-II (NTPC) | | | | | | | |

Format -5 Real time Security Desk

| | | | |
|-------------|--|--|---|
| Status | Details of real time security desk at each RLDC and NLDC | Details of outage scenarios built to be used by despatcher in real time for revising TTC calculations | Status of development of faster algorithm for real time updation of TTC calculations by load despatcher under outage conditions |
| Implemented | Provided in WRLDC control room | Security Desk person prepares the Base case in the morning as per the Load generation balance on the day available from WRLDC SCADA. After that Contingency ranking is done by PSS/E and accordingly top contingency is performed. Also all the emergency outage simulation is performed for making system N-1 secure after contingency. | |

FORMAT - 6 (AUDIT OF HVDC, TCSC SVC AND PSS TUNING)

| | | | | |
|---|--|--|--|--|
| Recommendation: 9.9.2.: An audit of devices such as HVDC, TCSC, SVC and PSS should be done immediately to ensure that their stability features are enabled. Further exercise of PSS tuning should be planned and implemented. Settings of these dynamic stabilizing devices should be reviewed at appropriate intervals. Action : CTU, STUs, Generators: Time Frame : 6 months. | | | | |
|---|--|--|--|--|

(A) Audit of HVDC

| | Location of HVDC | Audit status (completed on dd/mm/yyyy) | Observations of the audit and the name of audit agency | Action plan with timeline to remove deficiencies as per audit. |
|--------------|------------------------------|--|--|--|
| Maha | HVDC Chandrapur | Not Yet Audited | | |
| | Padghe | Not Yet Audited | | |
| Guj | | | | |
| CG | | | | |
| MP | | | | |
| WR-I (PG) | BHADRAVATI HVDC Back to Back | 22.01.2013 | WR-II and WRLDC Representative | No discrepancy Found. |
| WR-II (PG) | | | | |
| WR-I (NTPC) | | | | |
| WR-II (NTPC) | | | | |

(B) Audit of TCSC

| | Location of TCSC | Audit status (completed on dd/mm/yyyy) | Observations of the audit and the name of audit agency | Action plan with timeline to remove deficiencies as per audit. |
|--------------|------------------|--|--|--|
| Maha | | | | |
| Guj | | | | |
| CG | | | | |
| MP | | | | |
| WR-I (PG) | Raipur TCSC | 06.02.2013 | WR-II and WRLDC Representative | No discrepancy Found. |
| WR-II (PG) | | | | |
| WR-I (NTPC) | | | | |
| WR-II (NTPC) | | | | |

(C) Audit of SVC

| | Location of SVC | Audit status (completed on dd/mm/yyyy) | Observations of the audit and the name of audit agency | Action plan with timeline to remove deficiencies as per audit. |
|-----------|-----------------|--|--|--|
| Maha | | | | |
| Guj | | | | |
| CG | | | | |
| MP | | | | |
| WR-I (PG) | NA | NA | NA | NA |

| | | | | |
|---------------------------------|--|---|---|----------------|
| WR-II (PG) | | | | |
| WR-I (NTPC) | | | | |
| WR-II (NTPC) | | | | |
| | | | | |
| (D) Status of PSS Tuning | | | | |
| RPC (state wise) | Name and Location of generator identified for PSS tuning. | Audit status (completed on dd/mm/yyyy) | Action plan with time line to complete PSS tuning. | Remarks |
| Maha | 23 | | | |
| Guj | | | | |
| CG | | | | |
| MP | | | | |
| OSP | 1 | | | |
| ISP | 1 | | | |
| WR-I (PG) | NA | NA | NA | NA |
| WR-II (PG) | | | | |
| WR-I (NTPC) | | | | |
| WR-II (NTPC) | | | | |

| Constituents | Station | Unit | No. | Capacity (MW) |
|-----------------------|----------------|-------------|------------|----------------------|
| Gujarat | Wanakbori | TPS | 1 | 210 |
| | Wanakbori | TPS | 3 | 210 |
| Chattisgarh | Korba (W) | TPS | 1 | 210 |
| | Korba (W) | TPS | 3 | 210 |
| | Korba (W) | TPS | 2 | 210 |
| Madhya Pradesh | Satpura | STPS | 8 | 210 |
| | Satpura | STPS | 9 | 210 |
| | SGTPS | Birsinghpur | 1 | 210 |
| | SGTPS | Birsinghpur | 2 | 210 |
| | SGTPS | Birsinghpur | 3 | 210 |
| Maharashtra | SGTPS | Birsinghpur | 4 | 210 |
| | Nasik | TPS | 3 | 210 |
| | Nasik | TPS | 5 | 210 |
| | Parli | TPS | 2 | 210 |
| | Parli | TPS | 3 | 210 |
| | Parli | TPS | 4 | 210 |
| | Parli | TPS | 4 | 210 |
| NTPC | Korba | STPS | 2 | 210 |
| | Korba | STPS | 3 | 210 |
| | Korba | STPS | 4 | 210 |
| | Korba | STPS | 5 | 500 |
| | Korba | STPS | 6 | 500 |
| REL | Dahanu | TPS | 1 | 250 |
| | Dahanu | TPS | 2 | 250 |

Format-7 Voltage collapse prediction relay

Status of exploration of voltage collapse prediction relay

Action: RPCs, Time Frame: 1 year

| | |
|--------|--|
| | Recommendation :9.10.2: Possibility of voltage collapse prediction,sensing globalpower system conditions derived from local measurements may be explored |
| Status | In Boisar, A-eberlay Collapse Prediction relay was installed on 17 Oct,12 as a demo project. A-Eberle has now decommisioned these relay. |

Format-8 Telemetry facilities

Action: RPCs, Posoco, Time frame: 6 months

| POSO CO (Region /State/CPSU Wise) | Name and location of Generating station / transmission element without telemetry facility (A) | Fault in the telemetry / Reason for non-availability of telemetry(B) | Nature of the communication link for required telemetry in column(A) (Microwave/FO/PLCC) C | Action plan with time line to oerationalize the required telemetry facility (D) |
|--|---|--|---|--|
| GETCO | Bhatiya (3rd Trf.) | 220 | Not Integrated Yet | Sub-Station is ready but all lines are under construction stage |
| | Mokha | 220 | Not Integrated Yet | |
| MPPTCL | CHICLI | 220 | Not Integrated Yet | |
| | DHAR | 220 | Not Integrated Yet | |
| | PANAGAR | 220 | Not Integrated Yet | |
| | Khaparkheda GS | 500 | Telemetry Not availble | Maharastra have informed that they are taking up for alternate communication system from TTSL |
| | Deepnagar GS | 1000 | Telemetry Not availble | |
| | WARORA | 400 | New Stations Added , Integration still pending | |
| | LONIKAND NEW | 400 | | |
| | Taptitanda | 400 | | |
| | GHATGHAR | 400 | These stations are not availbale in New SCADA and thus not available at RLDC/NLDC | |
| | CHANDRAPUR 2 | 400 | These stations are not availbale in New SCADA and thus not available at RLDC/NLDC | |
| | HARANGUL | 220 | Maharastra have informed | |
| | KDPH | 220 | | |
| | KOLSHET | 220 | | |

| | | | | | |
|---------------|--|--------|---|------|---|
| MSETCL | LATUR | 220 | that they are taking up for alternate communication system from TTSL | | |
| | MAHAD | 220 | | | |
| | TEMGHAR | 220 | | | |
| | TILLARI | 220 | | | |
| | GHATGHAR | 220 | | | |
| | Lokmangal Shugar Ethanol, | IPP | Maharastra has informed that 4 major IPP and 8 small IPP have been integrated. The balance 18 small IPP in the state are taking up for integration for complete grid visibility | | Maharastra have informed that they are taking up with IPP for integration |
| | Yash Agro & Energy Ltd., | IPP | | | |
| | Gangakhed Sugar & Energy Ltd., | IPP | | | |
| | A A Energy, | IPP | | | |
| | JSW Steel Ltd., | IPP | | | |
| | Shree Sidhbali Ispat Ltd, | IPP | | | |
| | RPL Urja | IPP | | | |
| | M/s ISMT Ltd. | IPP | | | |
| | M/s Vasantrao Dada Patil Sahakari Sakhar Karkhana (SSK) Ltd. | IPP | | | |
| | | | | | |
| CSPTCL | NIL | NIL | NIL | NIL | NIL |
| | | | | | |
| DD | MAGARWAD | 220 | SCADA not Available | PLCC | New RTU Envisaged in New SCADA |
| | | | | | |
| DNH | KARARPAD | 220 kV | SCADA not Available | PLCC | New RTU Envisaged in New SCADA |
| | NEW KHARADPARA | 220 kV | SCADA not Available | PLCC | New RTU Envisaged in New SCADA |
| | SAYALI | 220 kV | SCADA not Available | PLCC | New RTU Envisaged in New SCADA |
| | KHADOLI | 220 kV | SCADA not Available | PLCC | New RTU Envisaged in New SCADA |
| | | | | | |
| GOA | CUNCOLIM | 220KV | | PLCC | To be done as part of new SCADA |
| | AMONA | 220KV | | PLCC | |

grp
SPS WR-SR

Annexure 8

CIN : U40105DL2009GOI188682

पावर सिस्टम ऑपरेशन कॉर्पोरेशन लिमिटेड
(पावरग्रिड की पूर्ण स्वामित्व प्राप्त सहायक कंपनी)
POWER SYSTEM OPERATION CORPORATION LIMITED
(A wholly owned subsidiary of POWERGRID)



पंजीकृत एवं केन्द्रीय कार्यालय: बी-9, प्रथम तल, कुतुब इंस्टीट्यूशनल एरिया, कटवारिया सराय, नई दिल्ली-110 016
Registered & Corporate Office : B - 9, 1st Floor, Qutub Institutional Area, Katwaria Sarai, New Delhi - 110 016
Website : www.posoco.in, www.nldc.in, Tel: 011-26536832, 26524522, Fax: 011-26524525, 26536901

Ref: NLDC/SR_synch_SPS/ 273

Date: 3rd June 2016

To
The Chief Engineer,
Maharashtra State Load Dispatch Center,
Thane-Belapur Road, P.o. Airoli,
Navi Mumbai - 400 708

प. क्ष. वि. स. मुंबई /WRPC
आवक संख्या /inward No. 1104
दिनांक /Date: 21/06/2016

Sub: Implementation of revised SPS setting for NEW-SR - reg.

Ref:

- MAHATRANSCO Letter No. MSLDC/tech/SO/00908, dated: 25th May 2016
- NLDC Letter No. NLDC/SR_synch_SPS/ dated: 16th March 2016
- NLDC Letter No. NLDC/SR_synch_SPS/1157 dated: 23rd Dec 2015

Dear Sir,

This is with reference to your letter mentioned above at S. No. (i). As you may kindly be aware, the present power system had been planned from 2007-08 considering Southern Region as surplus. However, the manner in which the situation has unfolded (heavy deficit in SR) had created insecure operating conditions in the past due to which several System Protection Schemes (SPS) had to be implemented for smooth transfer of power from NEW grid to SR grid. With the cooperation of all the stake holders and continuous monitoring, several new elements have been commissioned which has enhanced the TTC towards SR progressively. The SPS settings have also been progressively reviewed. The following table gives last date of operation of SPS on 400kV lines in WR-SR Corridor.

| S. No. | Logic as per NLDC's letter dated: 23 rd December 2015 | Last Date of SPS Operation |
|--------|---|---|
| 1 | Flow on either circuit of 400 kV Raipur – Wardha D/C crossing 850 MW and remaining above this value for 2.5 seconds or Tripping of any one circuit of 400 kV Raipur – Wardha D/C carrying 700 MW or above | 11/08/2015 (due to spurious signal), 10/8/2014 (actual last operation) |
| 2 | Flow on either circuit of 400 kV Wardha - Parli D/C crossing 850 MW and remaining above this value for | 29/09/2015 |

contd/-

| | | |
|---|---|------------|
| | 2.5 seconds or Tripping of any one circuit of 400 kV Wardha - Parli D/C carrying 750 MW or above | |
| 3 | Flow on either circuit of 400 kV Parli – Sholapur D/C crossing 800 MW and remaining above this value for 2.5 seconds or Tripping of any one circuit of 400 kV Parli – Sholapur D/C carrying 700 MW or above | 03/06/2015 |

It may be observed from the above table that post addition of new lines; the frequency of operation of SPS has reduced drastically. It may also be appreciated that while the system is N-1 complaint for large transfer, the system security has to be ensured for N-1-1 contingencies or greater. SPS is designed as a substitute for manual action, for making the process automatic and efficient during contingencies.

Considering the commissioning of transmission lines such as 765kV Raipur-Wardha D/C, 765kV Wardha-Aurangabad 4 circuits, 765kV Aurangabad-Sholapur D/C, 400kV Kolhapur (PG)-Kudgi D/C, SPS logic suggested in NLDC's letter mentioned at S. No. (iii) has been modified in NLDC's letter mentioned at S. No. (ii). The comparison of logics is mentioned below:

| S. No. | Logic as per NLDC's letter dated: 23 rd December 2015 | Logic as per NLDC's letter dated: 16 th March 2016 | Reason for modification and also the reason for choosing the setting |
|--------|---|---|--|
| 1 | Flow on either circuit of 400 kV Raipur – Wardha D/C crossing 850 MW and remaining above this value for 2.5 seconds or Tripping of any one circuit of 400 kV Raipur – Wardha D/C carrying 700 MW or above | SPS to be BLOCKED | SPS has been blocked considering the commissioning of 765kV Durg-Wardha D/C and anticipated commissioning of 2 nd 765kV Durg-Wardha D/C |

contd/-

| S. No. | Logic as per NLDC's letter dated: 23 rd December 2015 | Logic as per NLDC's letter dated: 16 th March 2016 | Reason for modification and also the reason for choosing the setting |
|--------|---|---|---|
| 2 | Flow on either circuit of 400 kV Wardha - Parli D/C crossing 850 MW and remaining above this value for 2.5 seconds or Tripping of any one circuit of 400 kV Wardha - Parli D/C carrying 750 MW or above | Tripping of any one circuit of 400 kV Wardha - Parli D/C and flow on other circuit > 750 MW | <ul style="list-style-type: none"> This SPS has never operated after the commissioning of 765kV Aurangabad-Sholapur D/C. Under outage of both circuits of 765kV Aurangabad-Sholapur, even with both circuits of 400kV Wardha-Parli in service, angle between Wardha & Parli would cross 30 degrees. Considering the commissioning of 765kV Aurangabad-Sholapur D/C, flow based SPS has been modified to tripping based. |
| 3 | Flow on either circuit of 400 kV Parli – Sholapur D/C crossing 800 MW and remaining above this value for 2.5 seconds or Tripping of any one circuit of 400 kV Parli – Sholapur D/C carrying 700 MW or above | Flow on either circuit of 400 kV Parli – Sholapur D/C crossing 800 MW and remaining above this value for 2.5 seconds Or Tripping of any one circuit of 400 kV Parli – Sholapur D/C and flow on other circuit > 700 MW | <ul style="list-style-type: none"> Under heavy flow towards SR and when 765kV Aurangabad-Sholapur D/C is in service, the flow on 400kV Parli-Sholapur D/C would not touch SPS setting of 850 MW/ckt. Under outage of both ckts of 765kV 765kV Aurangabad-Sholapur, even with both ckts of 400kV Parli-Sholapur in service, the voltage at Parli would go below 380kV and the flow on Parli-Sholapur would touch its thermal limit. Hence, flow based SPS on Parli-Sholapur was preferred. |

It can be observed from the above table that 400kV Raipur-Wardha SPS has been blocked, 400kV Wardha-Parli SPS has been changed to tripping based SPS.

It was observed that the system is vulnerable to a double or multiple contingencies which occur very frequently in the grid. There is also a difference between a double contingency in planning as well as double contingency in system operation. In the former, a double contingency is a rare event and is taken to occur simultaneously. In the operating horizon, it is different. Two trippings occurring within 15 minutes of each other is a double contingency as far as the operator is concerned as little

contd/-

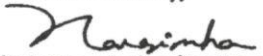
action is possible manually within this period (barring change of HVDC set points which is again subject to margins available). Double contingencies are also quite frequent as is evident from the number of grid disturbances (GDs) in the system available in NLDC's operational feedback to CEA and CTU.

In this regard, you may also be aware about the simultaneous tripping of 765kV Aurangabad-Sholapur D/C tripping on 1st March 2016. Due to this tripping, flow on 400kV Wardha-Parli D/C crossed 800 MW per circuit and the flow on 400kV Parli-Sholapur D/C has crossed 830 MW per circuit and the voltage at Sholapur has touched as low as 360kV. 200 MW load shedding during this event in Western Maharashtra would have helped in maintaining the voltage at Parli and Sholapur within the range mentioned in IEGC. Similar incident occurred on 9th February 2016 wherein 765 kV Aurangabad-Sholapur circuit-I tripped On B-Ph to Earth fault. Prior to tripping, 765 kV Aurangabad-Sholapur circuit-II was under continuous shutdown and circuit-I was carrying 1950 MW. After tripping of 765 kV Aurangabad-Sholapur-I Power flow on 400 kV Wardha-Parli D/C went up from 700 MW to 930 MW. Angular difference between Thrissur - NTPC Vindhyachal increased from 90 degrees to 120 degrees. Voltages at 400 kV Parli (PG) and 400 kV Sholapur (MS) reduced drastically. SPS of Wardha-Parli acted leading to load shedding in SR and generation backdown in WR, thus helping the system.

Load shedding and Generation back down for each SPS schemes on 400kV lines in WR-SR corridor was suggested in NLDC letter dated 16th March 2016 keeping in mind about this type of incredible contingencies mentioned above. It has been observed that Maharashtra is reluctant to provide load relief in Western Maharashtra (under SPS-5 & SPS-6) as well as generation reduction of 800 MW (under SPS-5). In view of above, please ensure implementation of the above SPS in entirety.

Thanking you,

Yours faithfully,


(S R Narasimhan) 3/6/2016

Additional General Manager,
System Operation, NLDC

Encl:

- 1) Plots corresponding to event on 1st Mar 2016
- 2) Plots corresponding to event on 9th Feb 2016

Copy for kind information to:

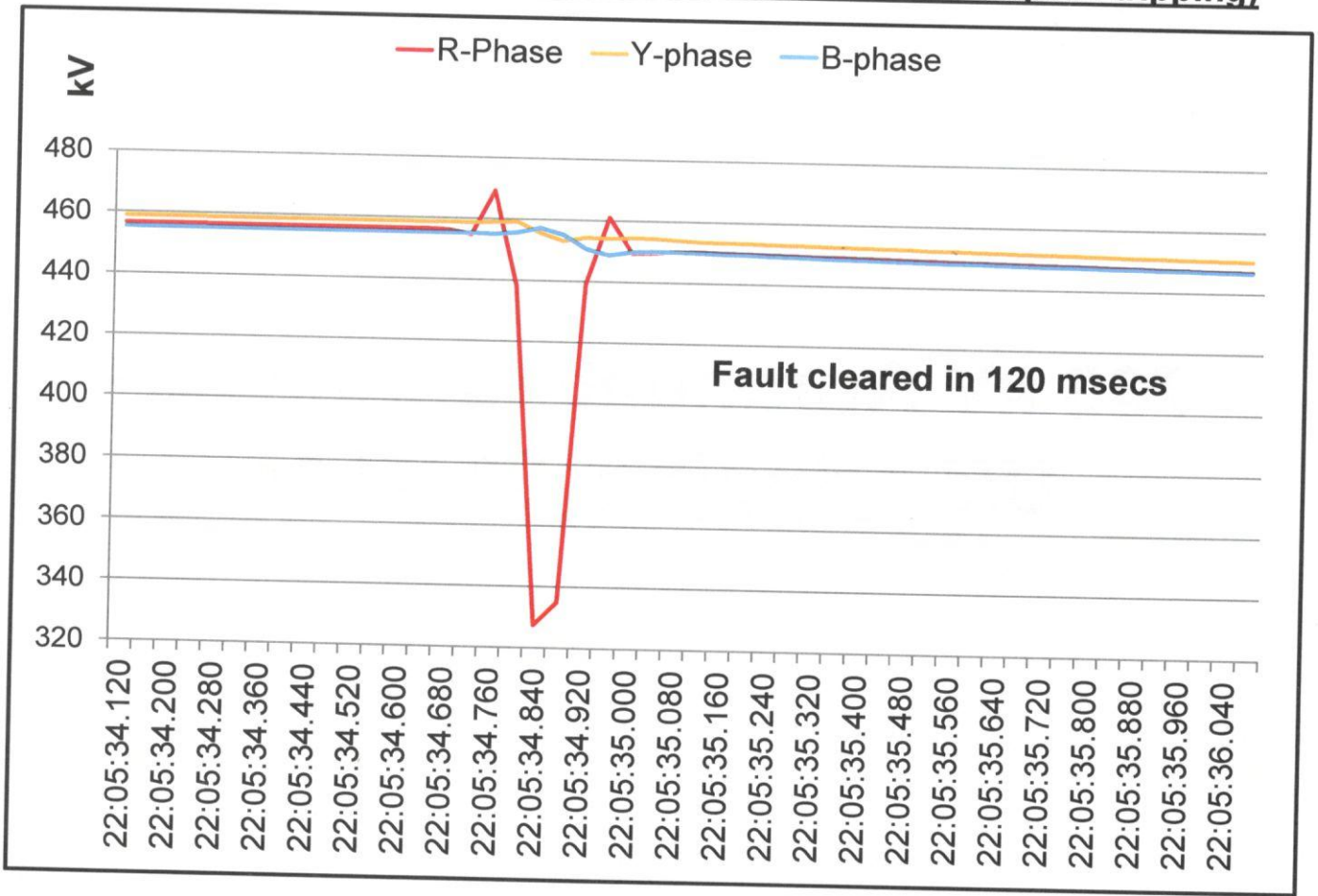
- 1) Member Secretary, WRPC Mumbai
- 2) GM WRLDC, Mumbai

765 kV Aurangabad-Solapur- D/c Tripping_01.03.16

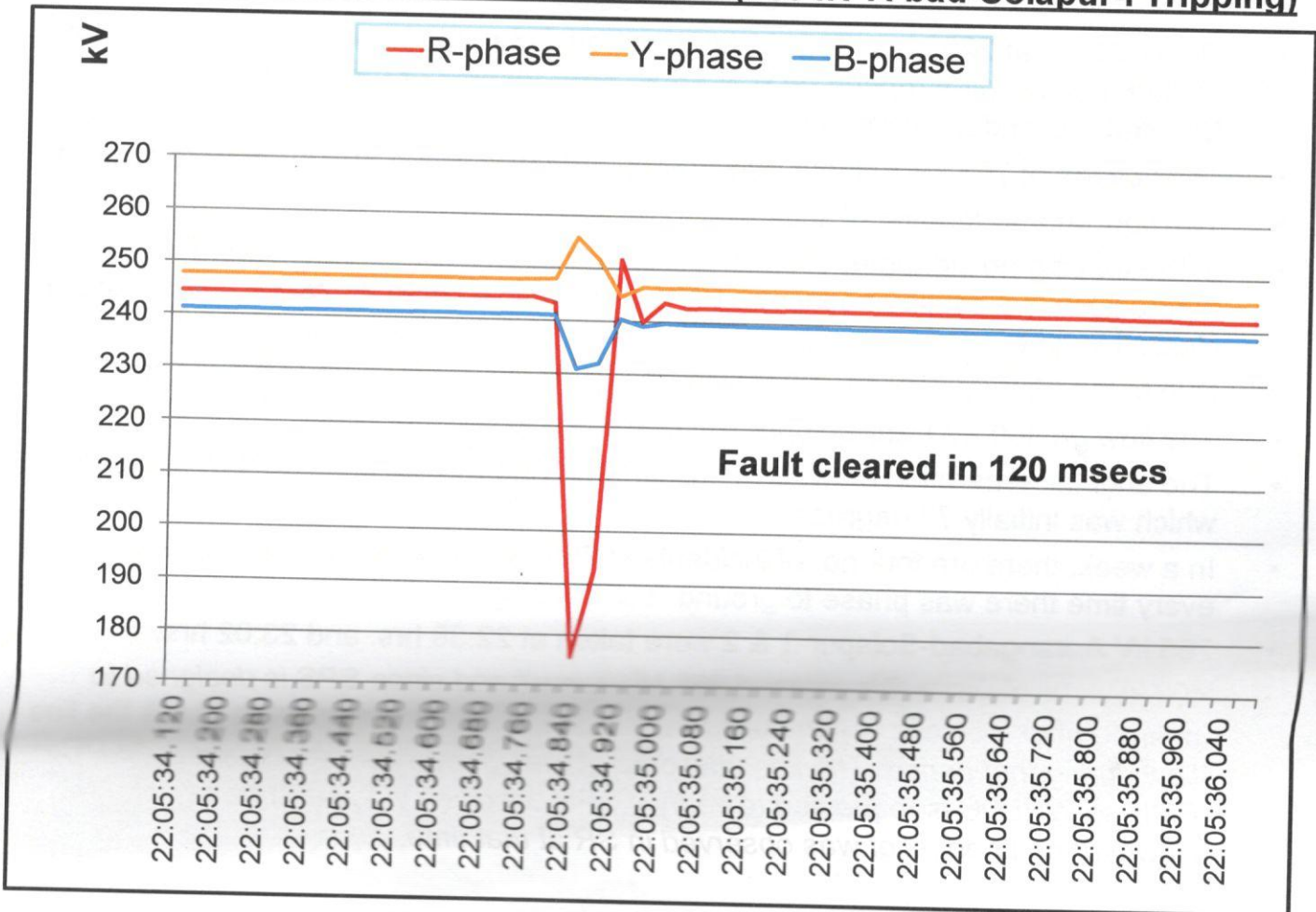
Incident

- On 01.03.16, at 2205 hrs, 765 kV Aurangabad-Solapur-I tripped on R-N Fault and at 2206 hrs, circuit-II tripped on B-N Fault. After tripping of Circuit-I the flow on Circuit-II crossed 2000 MW before tripping.
- The voltage at 765 kV Solapur and Aurangabad was within 800 kV prior to tripping.
- The flow prior to tripping of lines was 1200 MW/circuit.
- In the tripping no signature of AutoReclose was observed and non operation of autoreclose is a cause of concern. PMU has captured both the faults and faults got cleared in time.
- Due to the tripping flow on 400 kV Wardha-Parli D/c crossed 800 MW per circuit.
- The flow on 400 kV Parli-Solapur D/c crossed 830 MW per circuit.
- The angular separation between Thrissur and Vindhyachal crossed 110 degrees which was initially 77 degrees.
- In a week, there are four no. of incidents in 765 kV Aurangabad-Solapur D/c and every time there was phase to ground fault causing tripping of the line.
- 765 kV Aurangabad-Solapur-1 & 2 were taken at 22:38 hrs. and 23:02 hrs.
- *400 kV Parli-Solapur D/c crossed 800 MW/circuit and since **SPS** is designed to operate after 2.5 secs of line flow crossing 800 MW, it is important to check the line flow during that period. The line flow data of the period was intermittent at NLDC PMU so WRLDC is requested to verify if SPS condition was satisfied or not. However no Load relief was observed in SR at that time.*

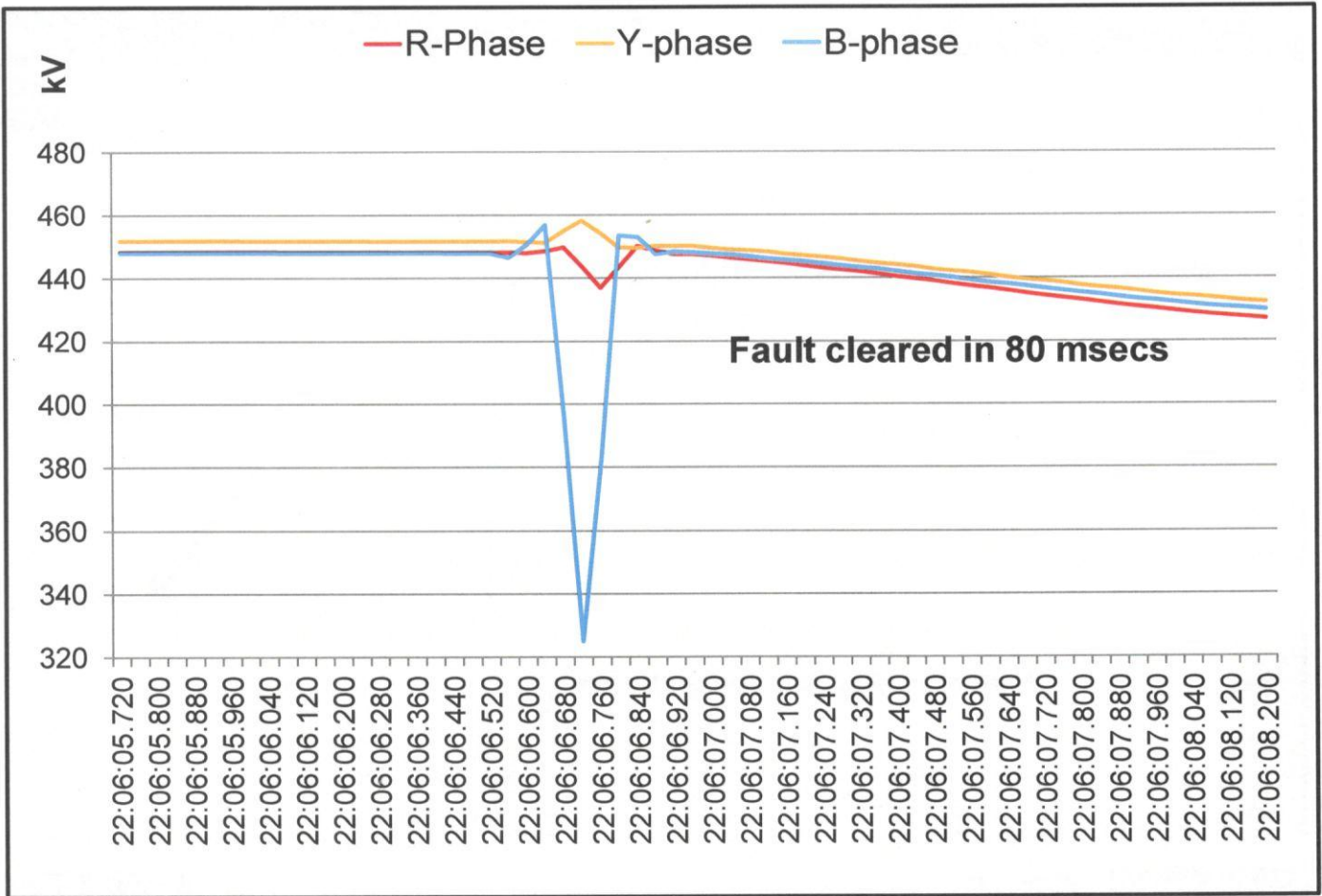
R-N Fault captured in Solapur PMU (765 kV A'bad-Solapur-I tripping)



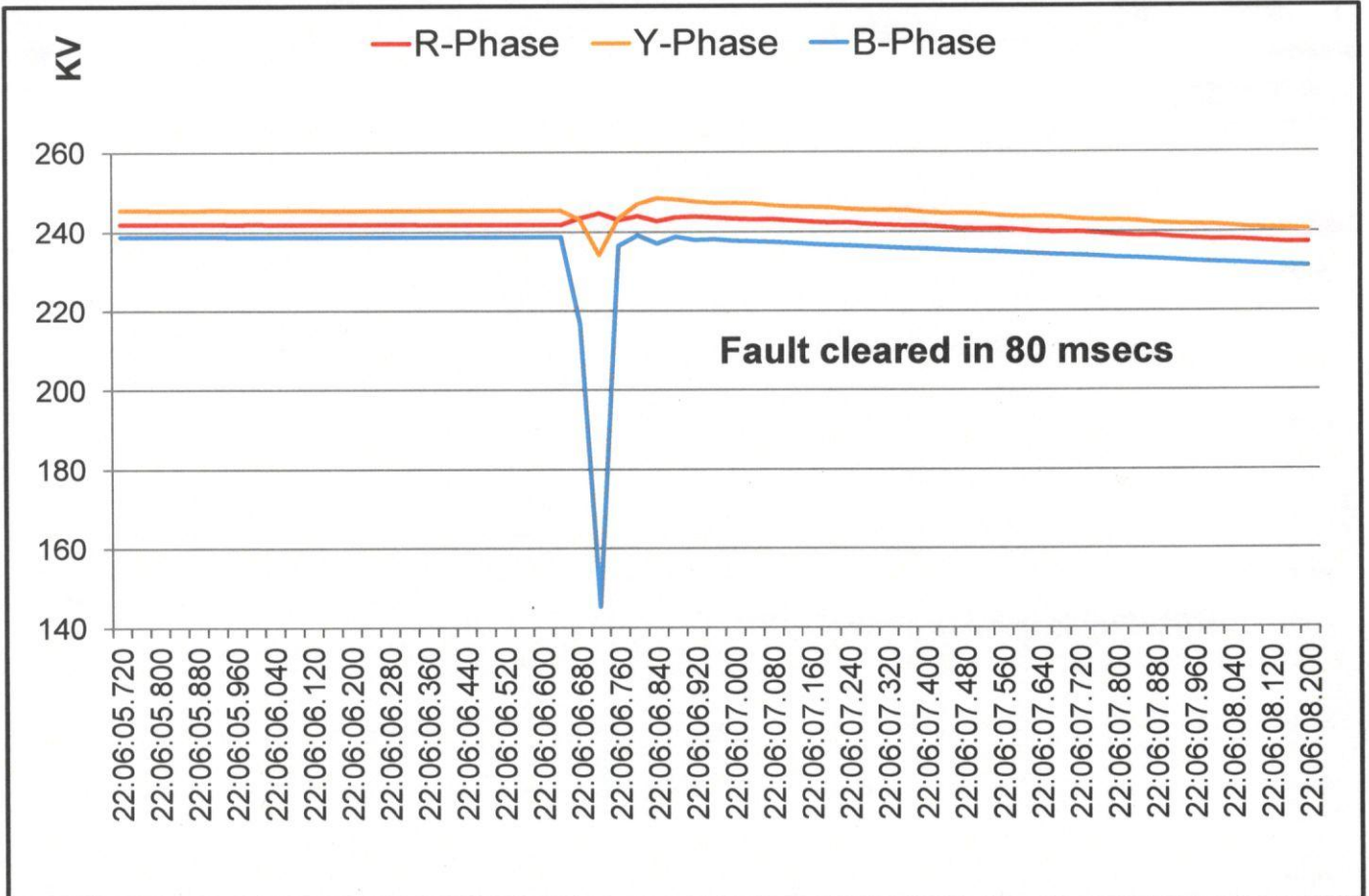
R-N Fault captured in Aurangabad PMU (765 kV A'bad-Solapur-I Tripping)



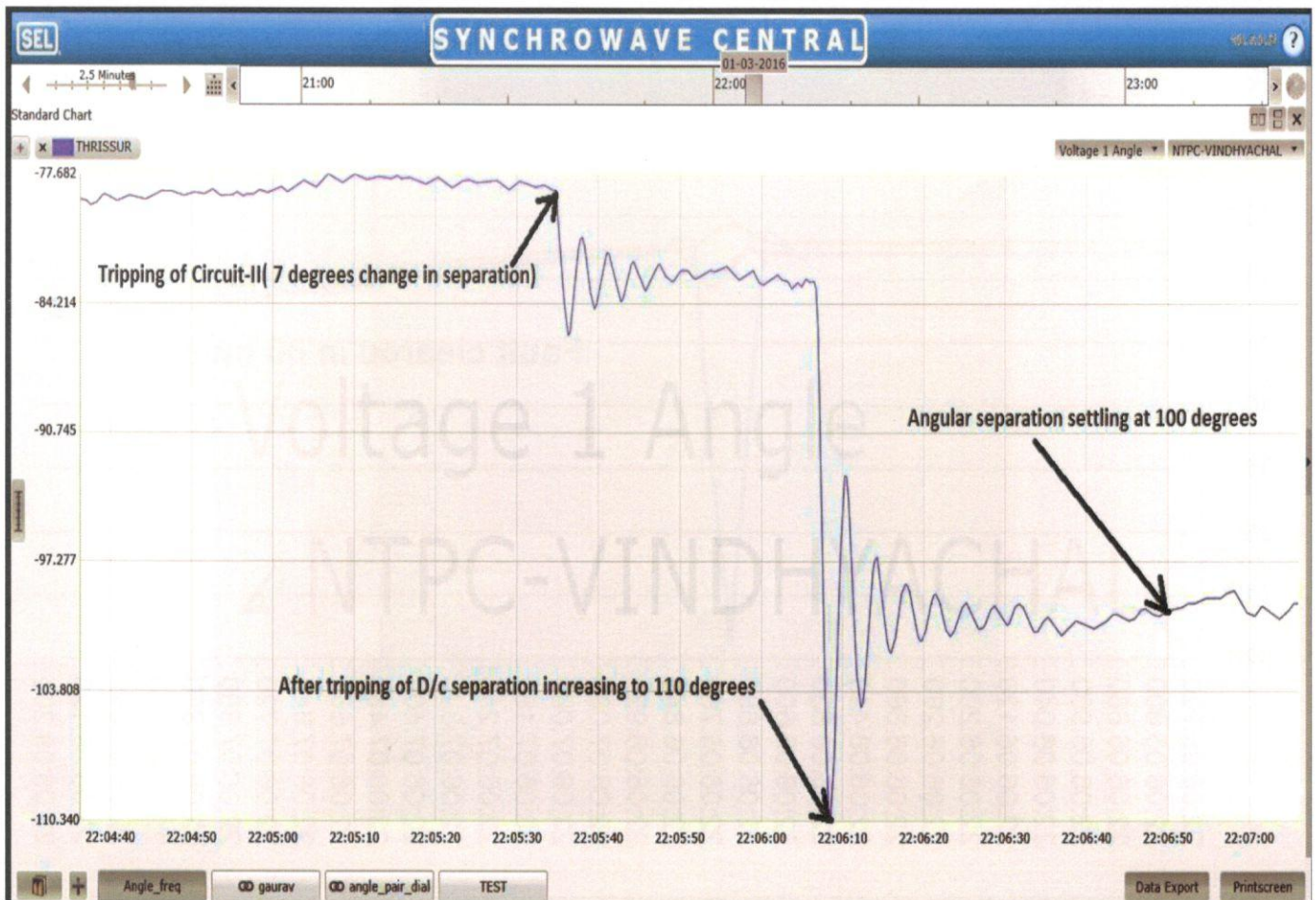
B-N Fault captured in Solapur PMU (765 kV A'bad-Solapur-II tripping)



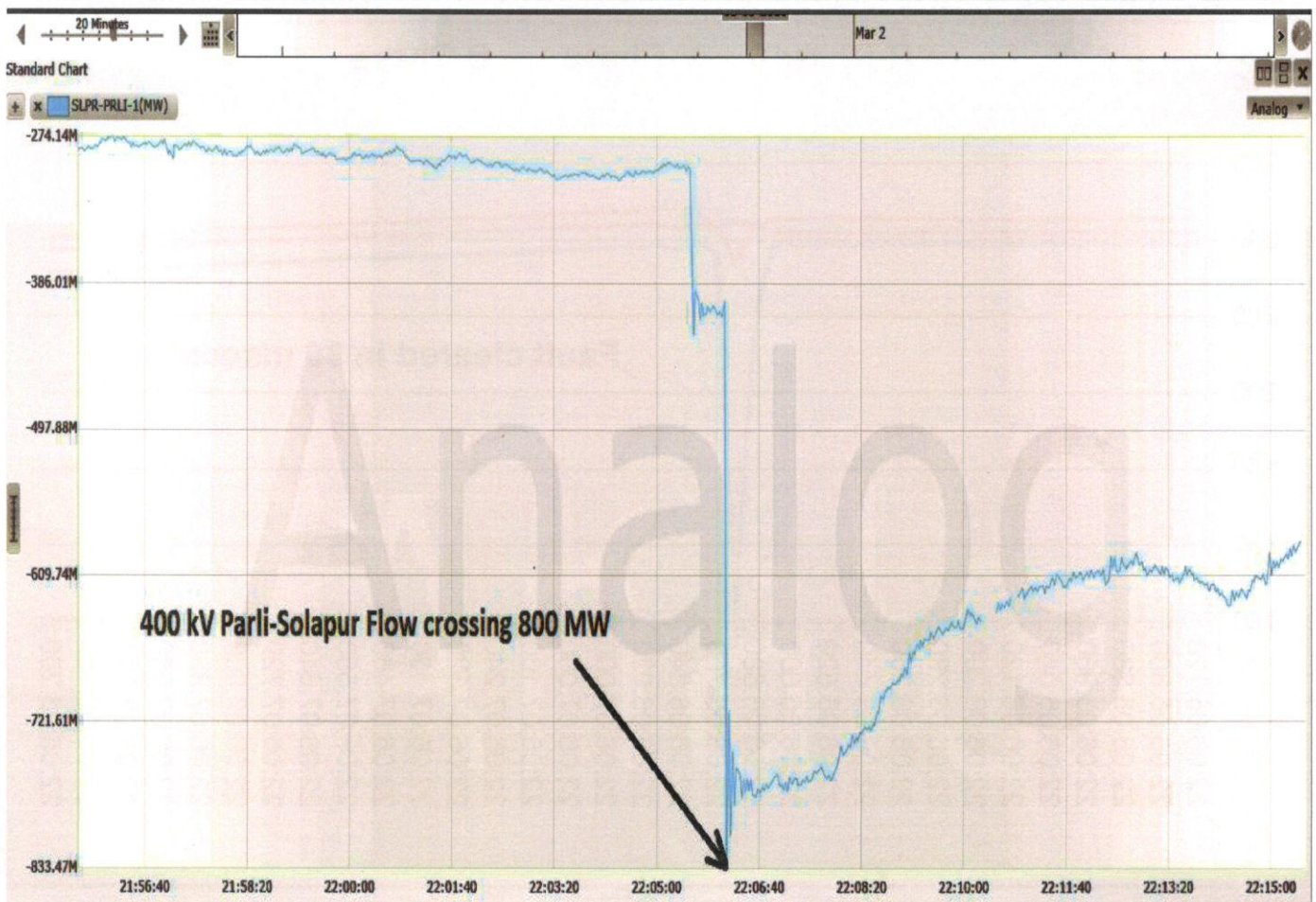
B-N Fault captured in Aurangabad PMU (765 kV A'bad-Solapur-II tripping)



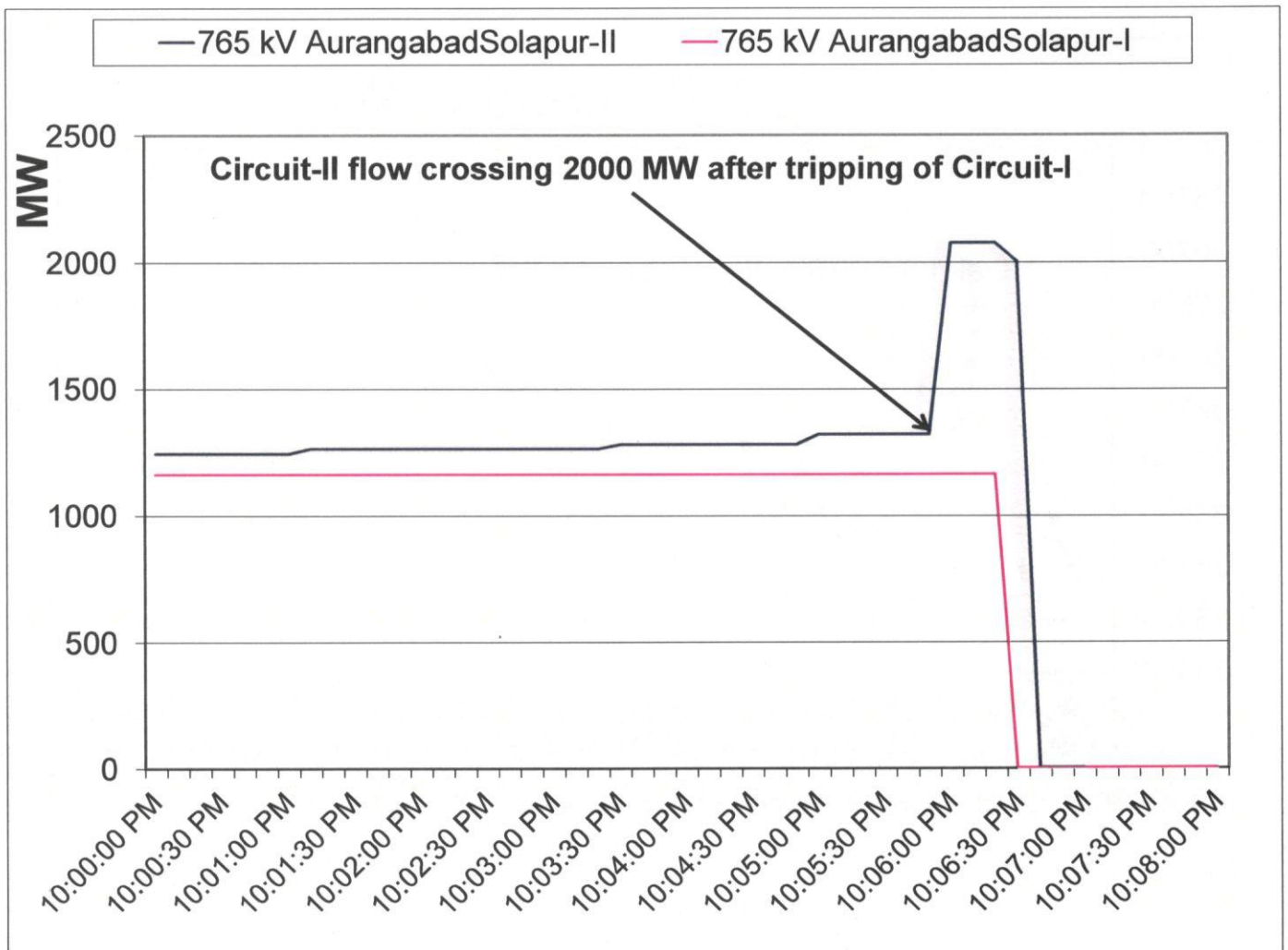
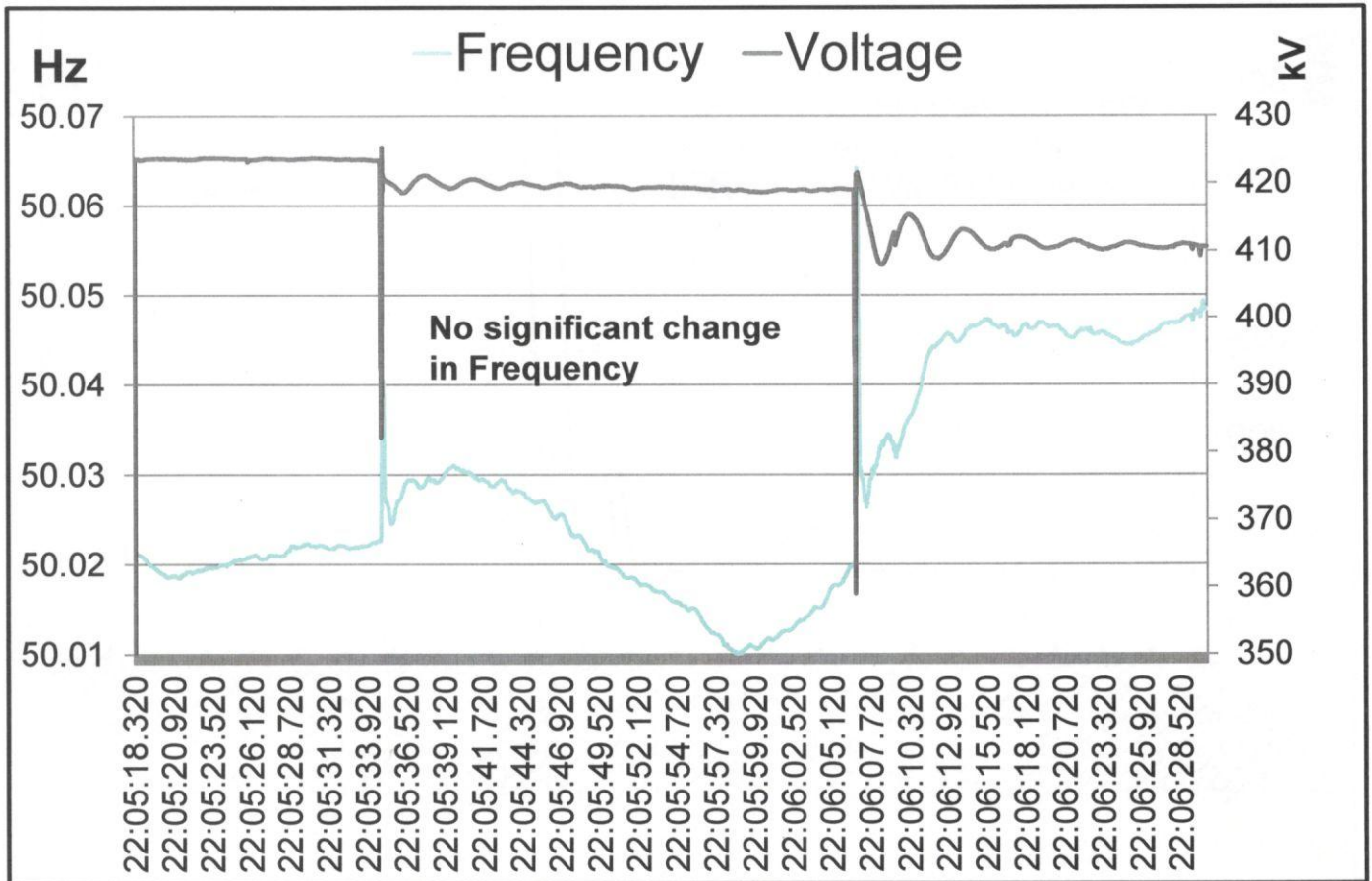
Angular Separation (Thrissur w.r.t. NTPC Vindhyachal)

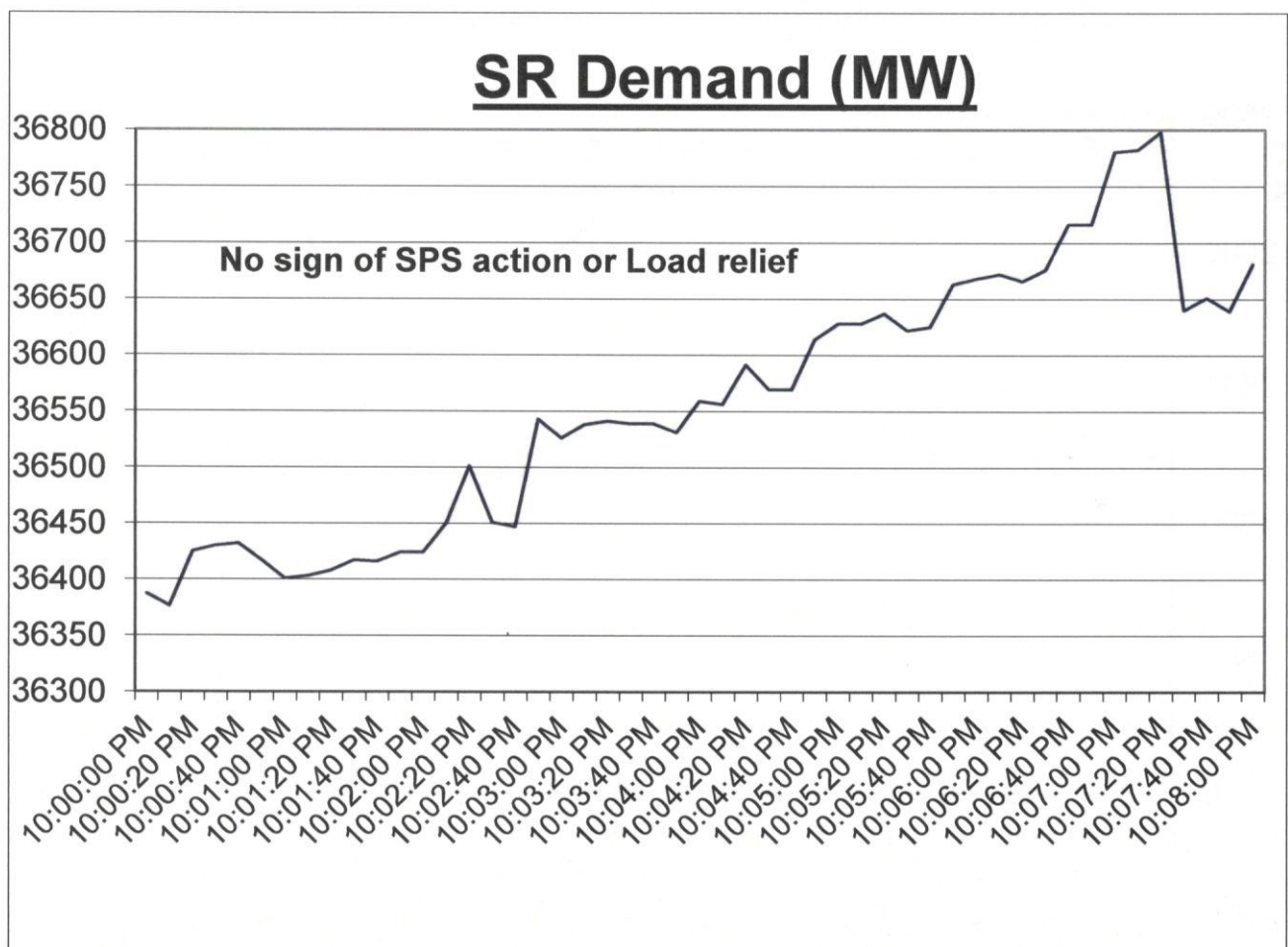
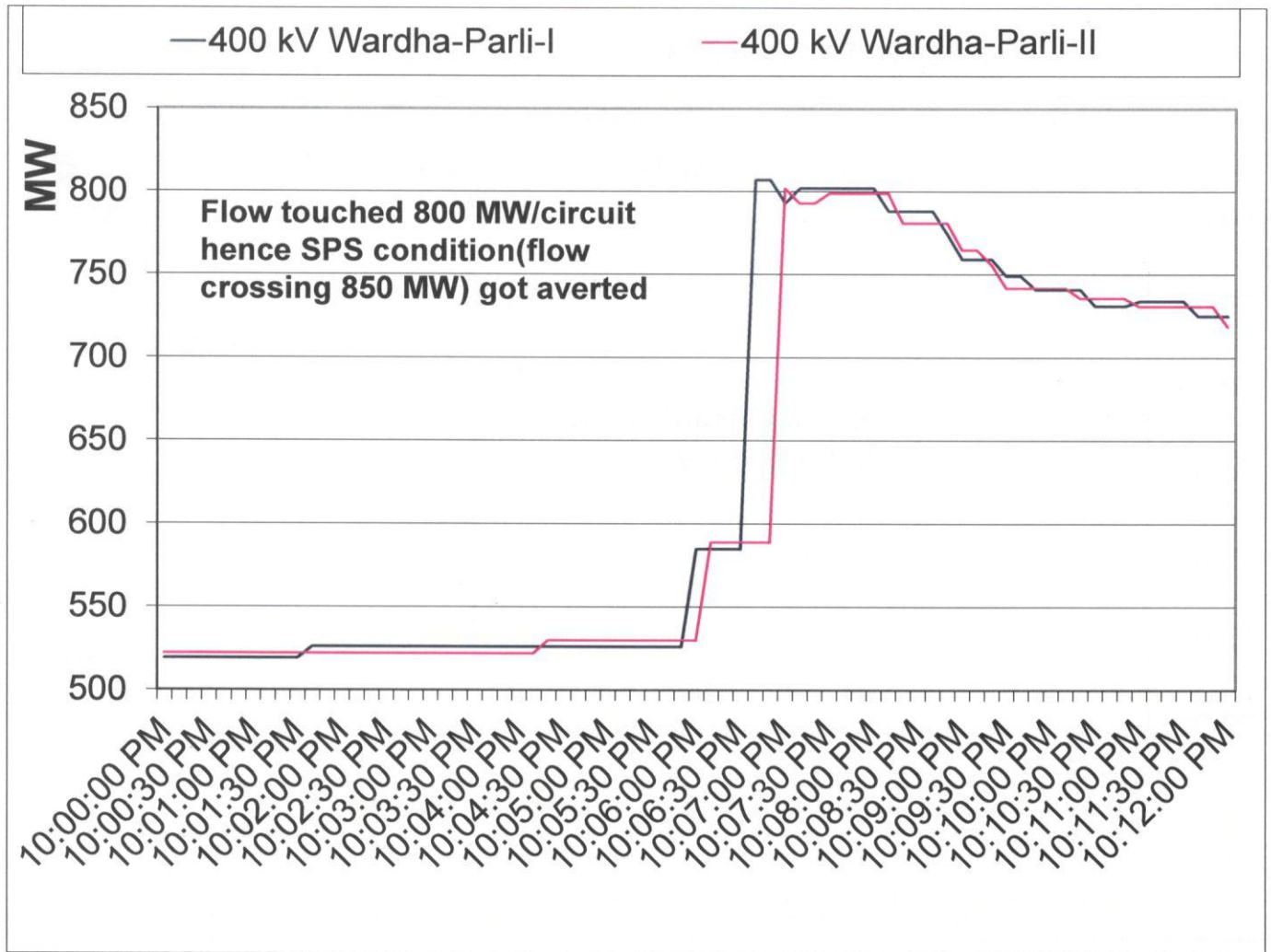


Power Flow of 400 kV Parli-Solapur (SPS criteria satisfied ?)



Frequency Variation with Voltage

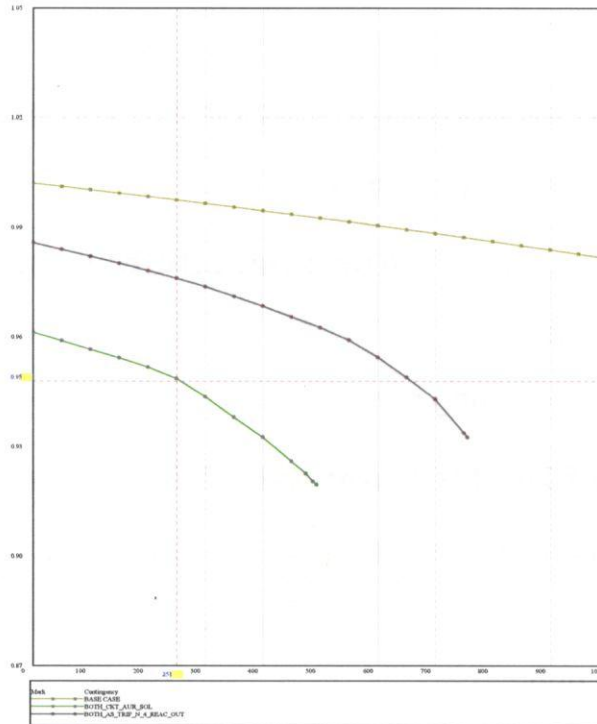




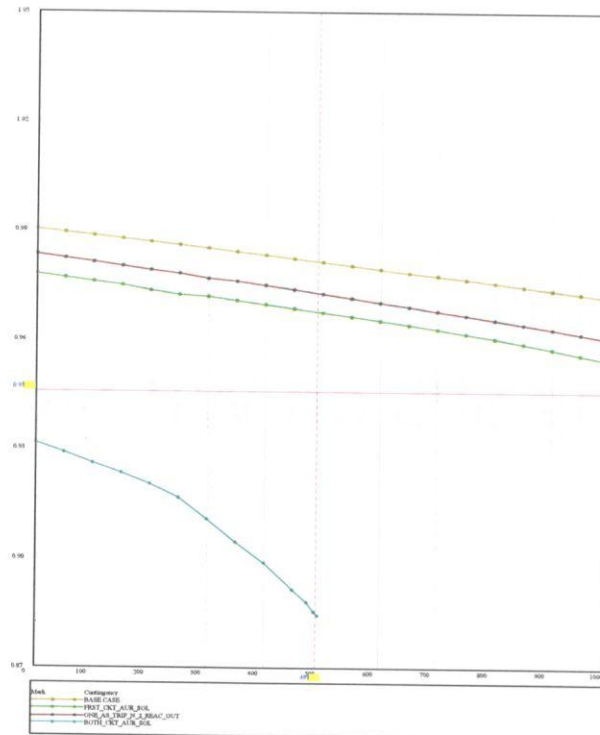
Meeting convened by SRPC regarding SPS on WR-SR corridor

POSOCO

Base Case: 3000 MW from WR to SR



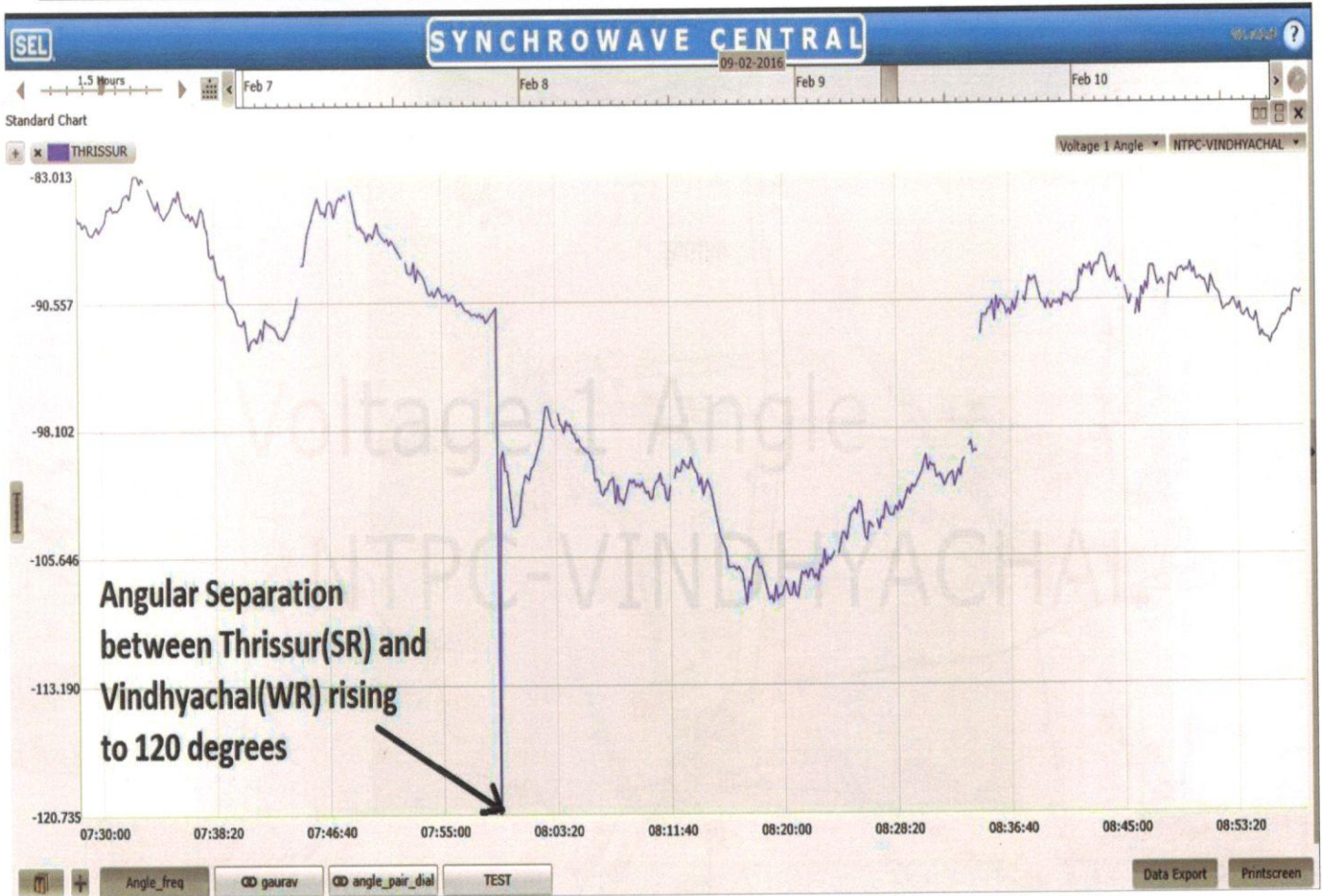
Base Case: 4000 MW from WR to SR



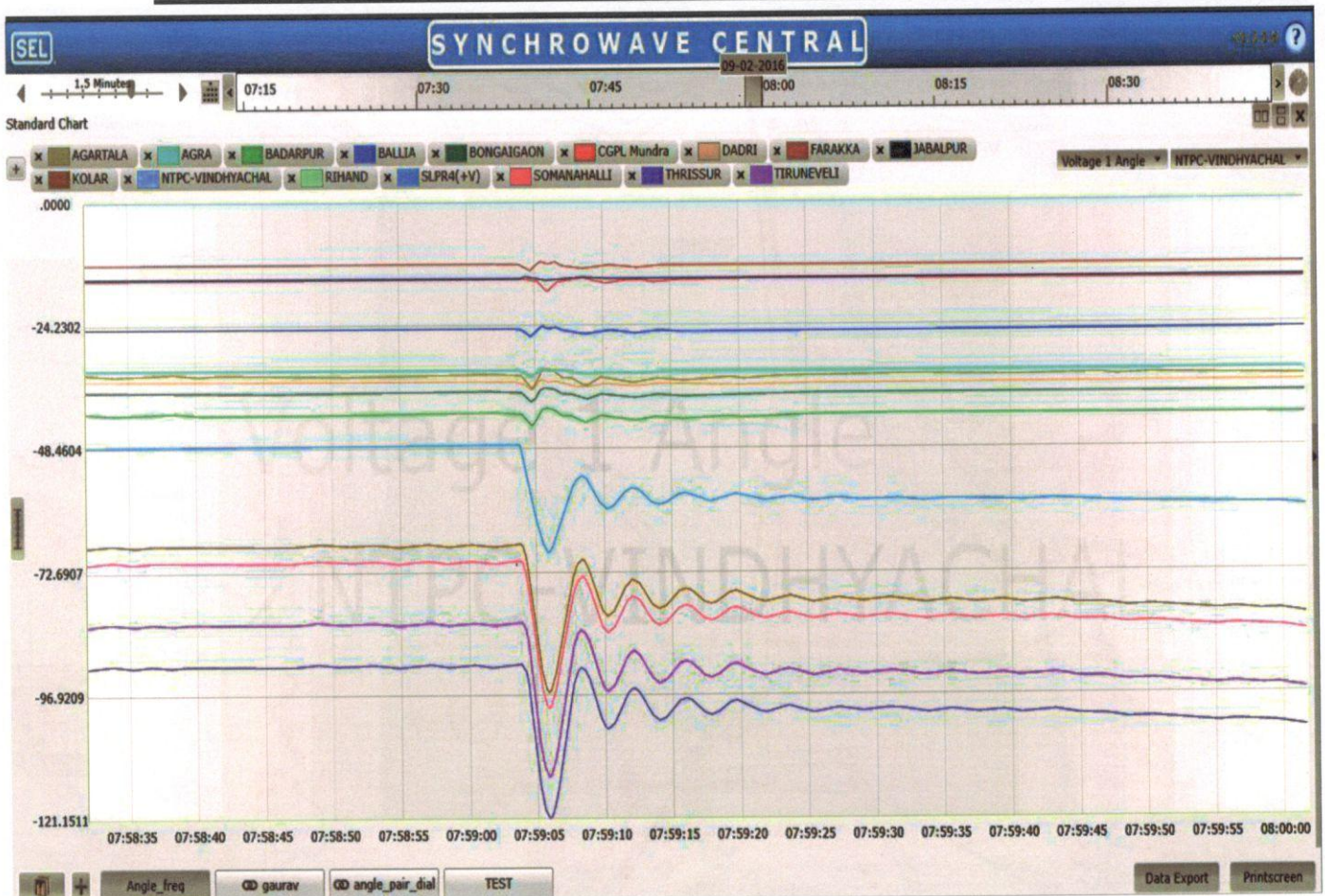
Loss of both circuits of 765 kV Aurangabad - Sholapur

- At 07:59 Hrs on 9th February, 765 kV Aurangabad-Sholapur I tripped On B-ph to Earth fault.
- Prior to tripping, 765 kV Aurangabad-Sholapur II was under continuous shutdown
 - Line I was carrying 1950 MW.
- After tripping of 765 kV Aurangabad-Sholapur I
 - Power flow on 400 kV Wardha-Parli D/C went up from 700 MW to 930 MW
 - Angular difference between Thrissur - NTPC Vindhyachal increased from 90 deg to 120 deg.
 - Voltages at 400 kV Parli (PG) and 400 kV Sholapur (MS) reduced drastically.
 - SPS of Wardha-Parli acted.

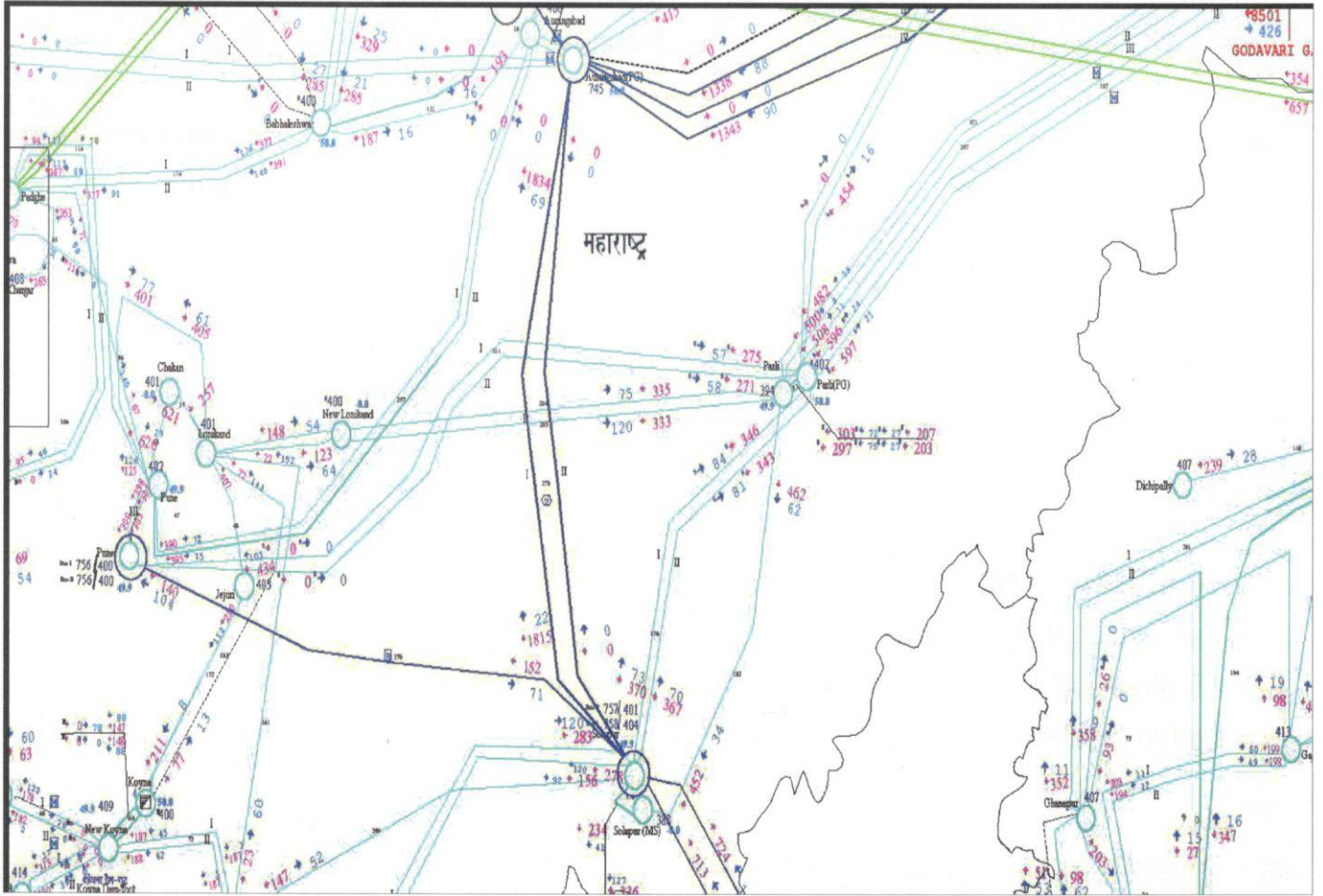
Thrissur(SR) angle with respect to Vindhyachal(WR)



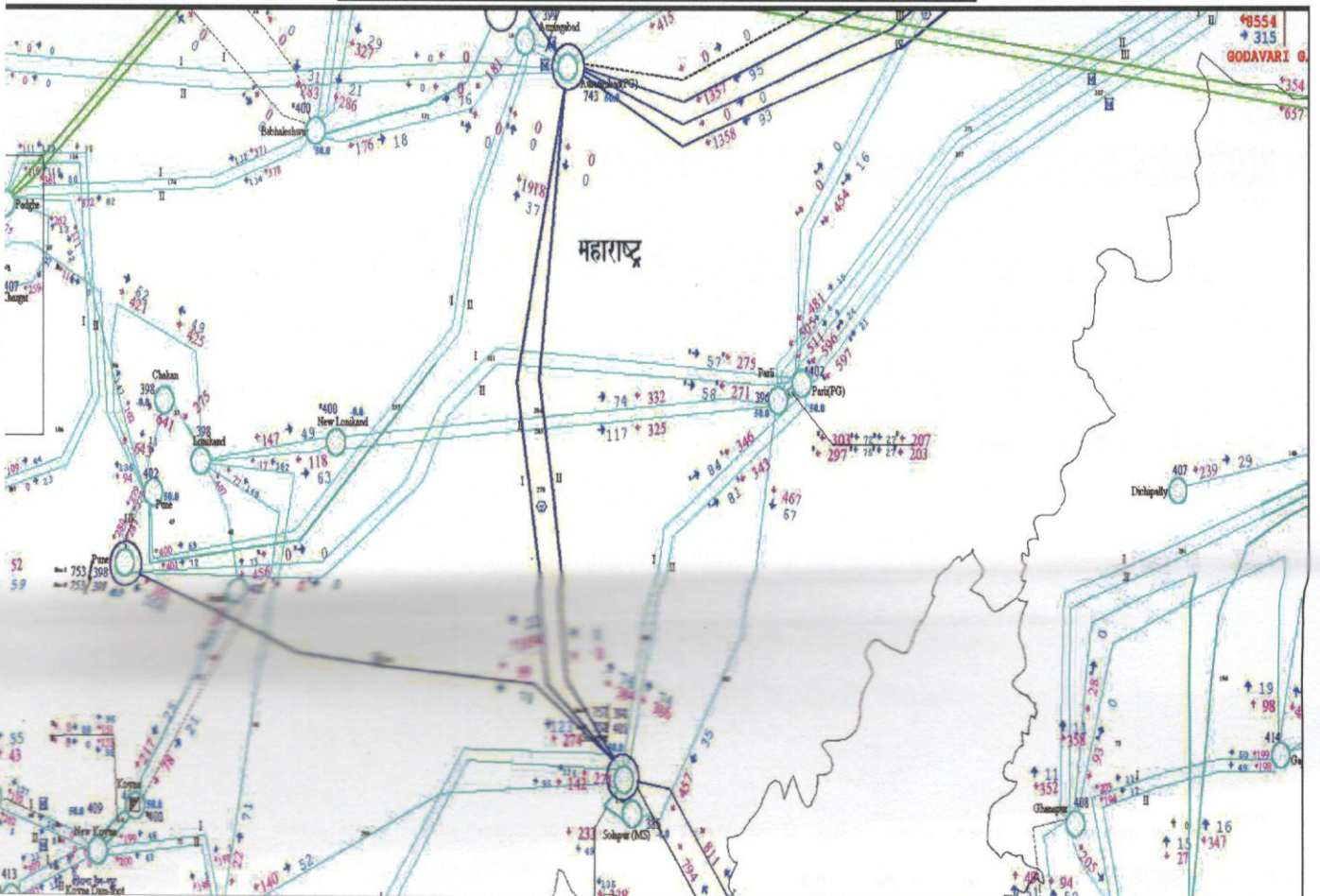
Angular Difference(Zoomed plot)



Network(at 0750 hrs)

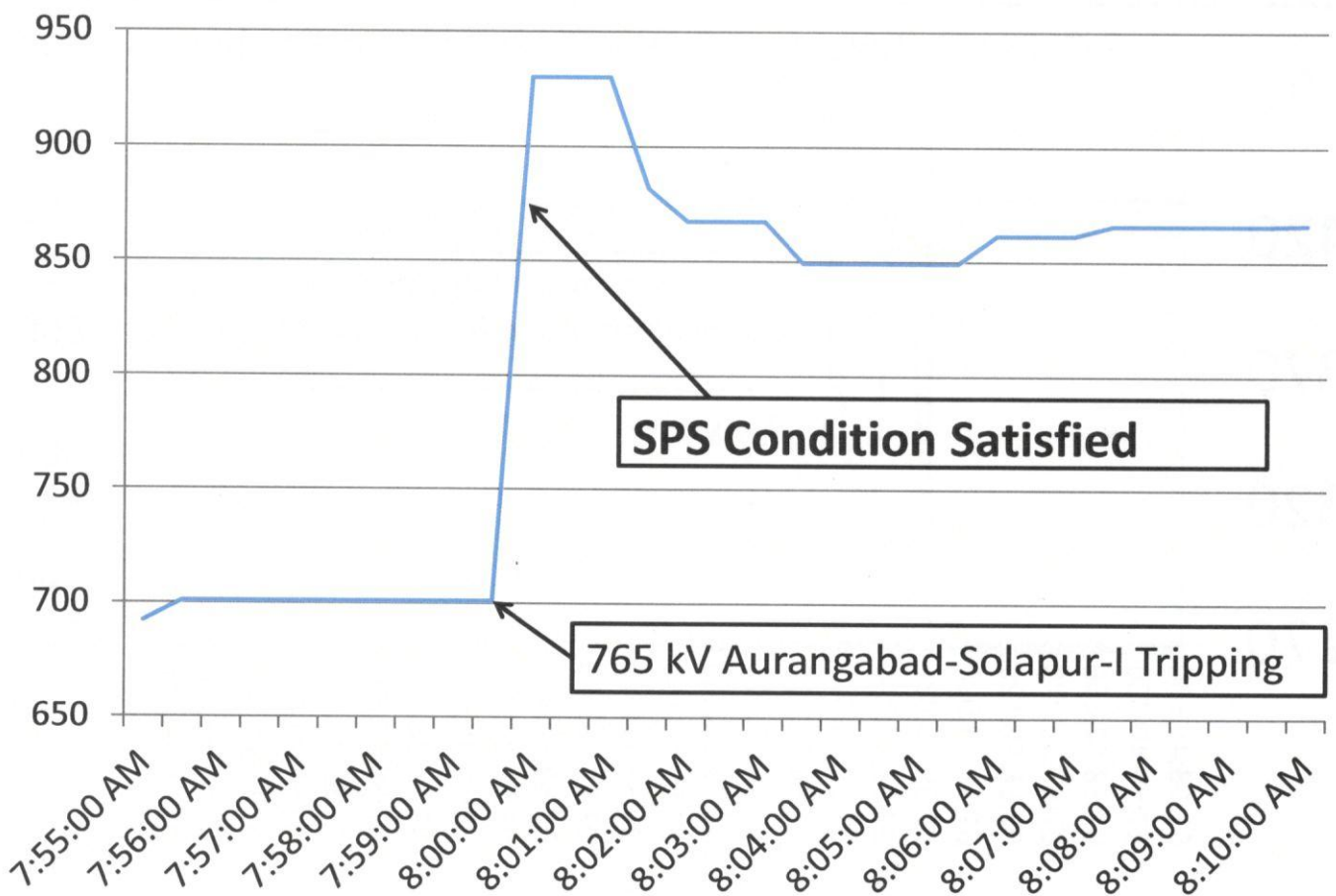


Network(at 0755 hrs)

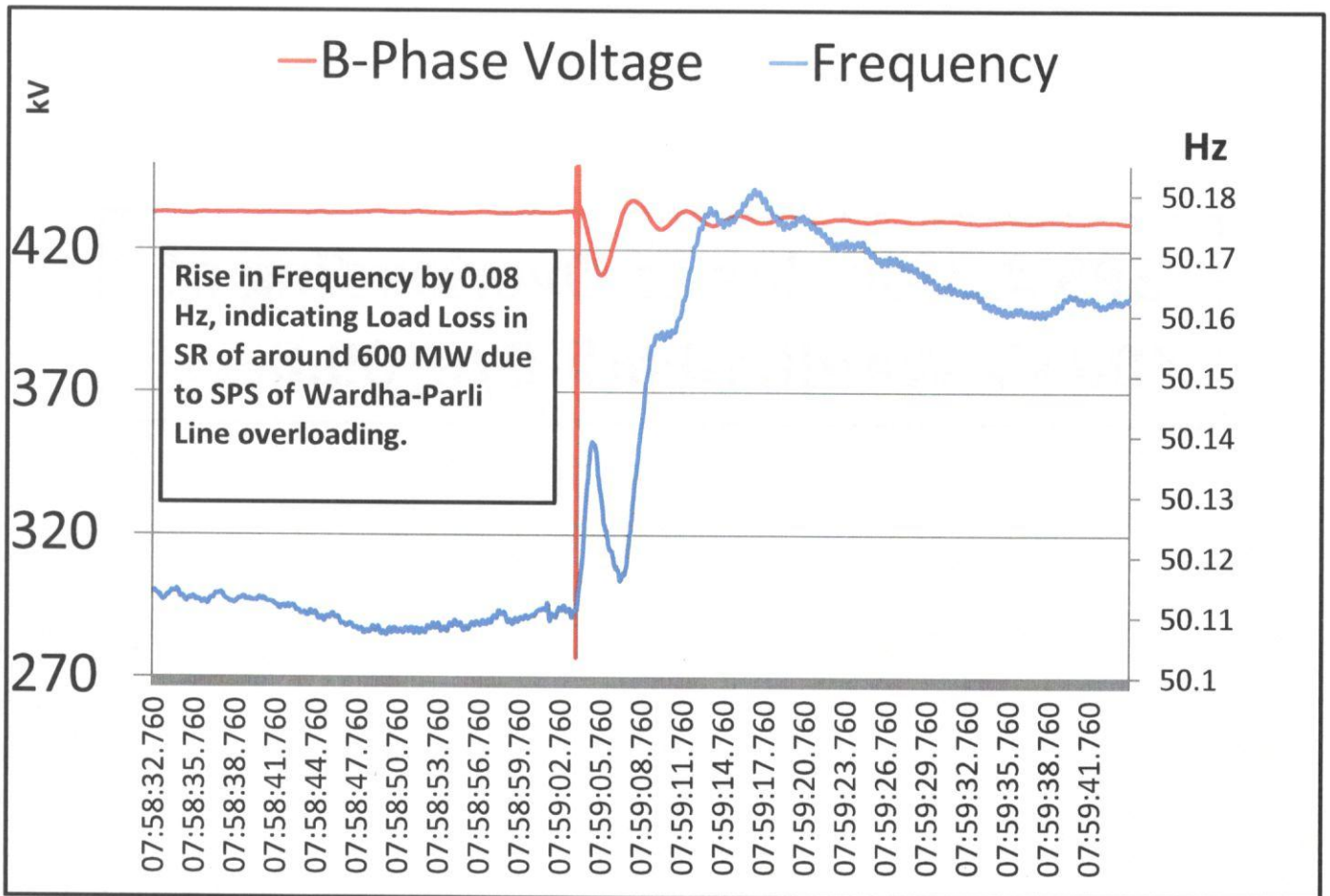


SPS Action due to Overloading of 400 kV Wardha-Parli-D/c_09.02.16

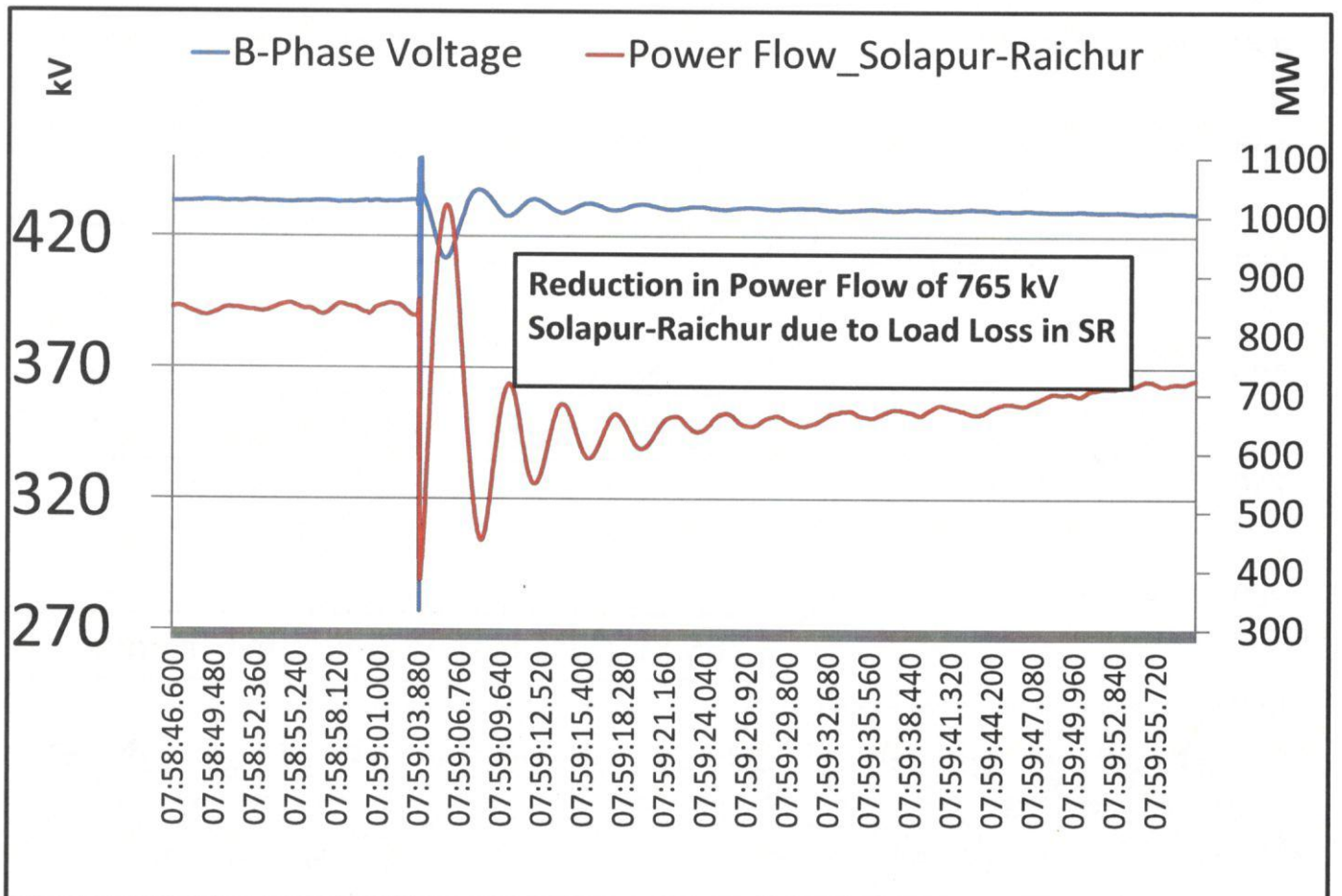
Line Loading (400 kV Wardha-Parli-I)



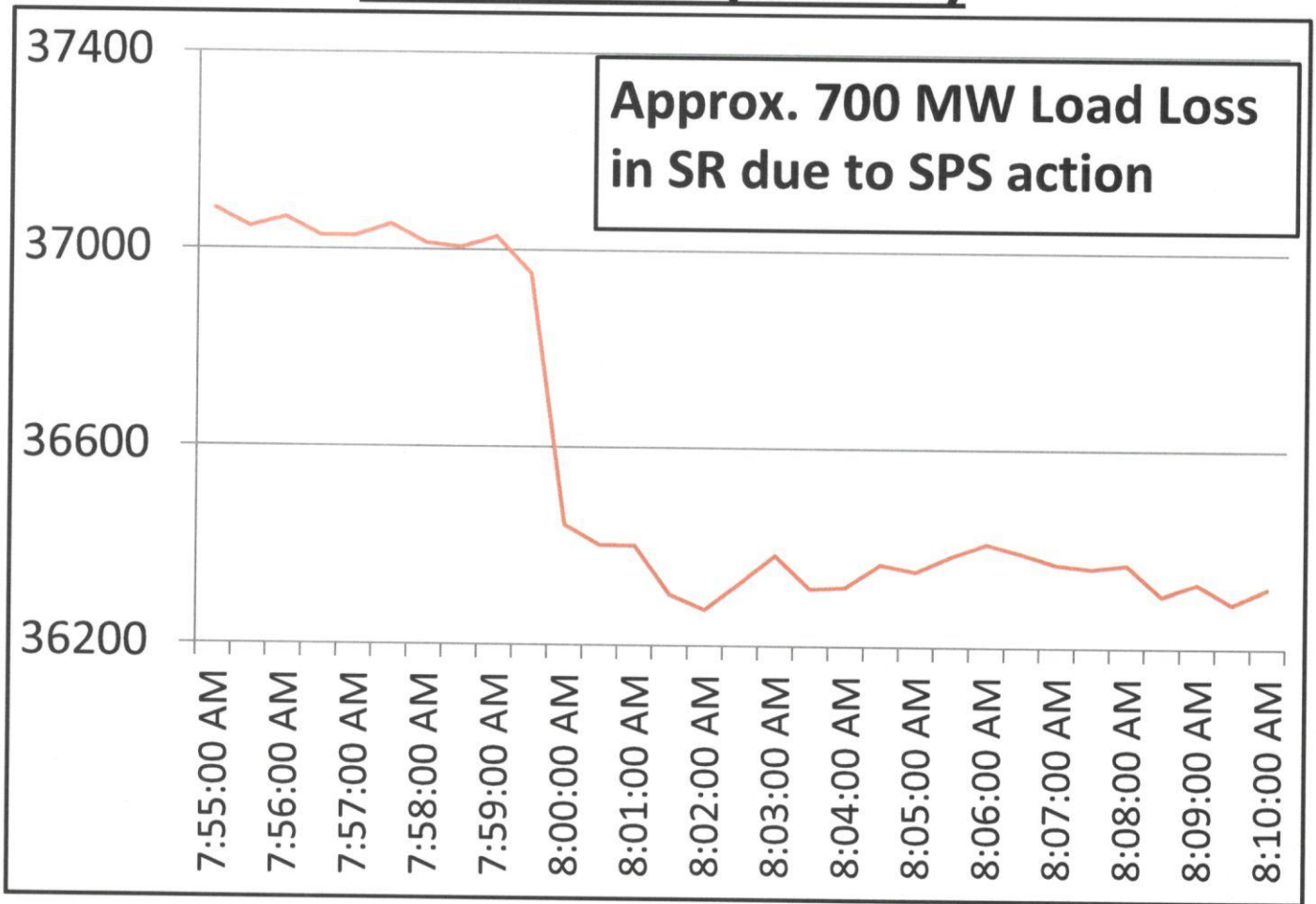
Frequency Rise



765 kV Solapur-Raichur-I Power Flow



SR Demand (in MW)



Annexure 9

Annex - 9



भारत सरकार
Government of India
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
पश्चिम क्षेत्रीय विद्युत समिति

Western Regional Power Committee

एफ -3, एमआयडीसी क्षेत्र, अंधेरी (पूर्व), मुंबई - 400 093
F-3, MIDC Area, Andheri (East), Mumbai - 400 093

दूरभाष Phone: 022- 28209506, 28200195; 28200196; फैक्स Fax : 022 - 28370193

Website : www.wrpc.gov.in

E-mail : prc-wrpc@nic.in protectionwrpc@gmail.com

NO. WRPC/Protection/SPS/2016/

956

आई एस ओ : 9001-2008
IS/ISO: 9001-2008

Date: 23.05.2016

To

1. ED, NLDC, POSOCO, 9, Katwaria Sarai, New Delhi-110016 Fax 011-26536901
2. GM, WRLDC, POSOCO, Mumbai: 400 093 Fax 022-28202630

Sub: Implementation of backing down generation of 1000MW (full quantum) in WR as part of SPS for reduction in import by NR on 765 kV Gwalior -Agra ckt I & II, by more than or equal to 3000MW-reg.

Sir,

The revision in settings for the SPS of 765kV Agra- Gwalior D/C lines, in view of the anticipated commissioning of 765kV Gwalior-Phagi D/C and 765kV Phagi-Bhiwani lines was proposed by NLDC vide letter dated 07.09.2015 and the backing down quantum of generation in WR was increased from 500MW to 1000MW for loss of import by NR on 765kV Agra Gwalior D/C lines by more than equal to 3000MW.

Accordingly, WRPC vide various correspondences has requested PGCIL and generating stations in WR for implementation of the SPS, proposed as above by NLDC and the copies of these correspondences were endorsed to WRLDC and NLDC for necessary coordination in implementation of revised SPS. The revision of SPS settings was implemented at VSTPS, CGPL, SASAN and KSTPS with backing down of 250MW each at these stations and the SPS setting at Gwalior end only was revised to 3000MW as intimated by PGCIL vide letter dated 11.02.2016. Since there is no Fiber Optic connectivity at SASAN, the signal from Gwalior is being transmitted to SASAN through PLCC and signal from Agra is being transmitted to other three stations viz VSTPS, KSTPS & CGPL through fiber optic.

The mock testing of the SPS was carried out on 12.05.2016 and during mock testing, signal for loss of 1500MW was generated at Agra end and receipt of the same at VSTPS,CGPL and KSTPS was confirmed by WRLDC vide their letter dated 18.05.2016.

It is learnt that the revised SPS at Agra end has not been implemented and the setting for loss of import by NR on 765kV Agra-Gwalior D/C lines, is still kept at 1500MW and not 3000MW as understood.

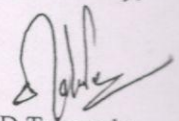
In view of the above you are requested to confirm implementation of SPS as per NLDC letter dated 07.09.2015 at Agra end also. In case the revision in SPS is not carried out as per letter dated 07.09.2015 at Agra end, the WR generating stations, VSTPS, KSTPS, CGPL and SASAN may please be advised to set their backing down quantum to 125MW each (the present backing down quantum implemented for this SPS is 250MW each) and PGCIL be advised to retain the original

setting of 1500MW (which at present is set at 3000MW) at Gwalior end for loss of import by NR on 765kV Agra-Gwalior D/C lines.

After confirming the implementation of revised settings (more than equal to 3000MW) for loss of import by NR on 765kV Agra-Gwalior D/C lines at Agra end, the WR generators may please be advised to implement backing down quantum's to 250MW each at VSTPS, KSTPS, CGPL and SASAN generating stations and PGCIL may be advised to revise the SPS setting at Gwalior end from 1500MW to 3000MW.

A confirmation regarding adopting same settings at both the ends(i.e. Agra & Gwalior) of either 1500MW or 3000MW loss of import by NR on 765kV Agra-Gwalior D/C lines may be intimated to enable to coordinate participation of WR generators in the SPS.

Yours' faithfully,



S.D. Taksande,
Member Secretary

- 1 Member Secretary, NRPC, Katwaria Sarai. Fax: 011-26865206
- 2 Director (Operation), NTPC, EOC, New Delhi. Fax: 011-24361018
- 3 Director (Operation), PGCIL, Saudamini, Sector - 29, Gurgaon-122 001 Fax 0124-2571922
- 4 Executive Director, (WR-I), PGCIL, Sampriti Nagar, Nagpur -440026, Fax.0712-2641471
- 5 Executive Director, (WR-II), PGCIL, Vadodara - 390 018 Fax. 0265-2488564
- 6 CEO, SASAN UMPP, Sasan MP.