भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
पूर्वी क्षेत्रीय विद्युत समिति
Eastern Regional Power Committee
14, गोल्फ क्लब रोड, टालीगंज, कोलकाता-700033
सत्यमेव जयते
Azadi Ka Amrit Mahotsav
Tel. No.: 033-24239651,24239658 FAX No.:033-24239652, 24239653 Web: **www.erpc.gov.in**

सं./NO. पू.क्षे.वि.स./PROTECTION/2022/ 1126 **दिनांक /DATE:02.12.2022**

सेवा में / To,

संलग्न सूची के अनुसार / As per list enclosed.

विषय : दिनांक - 16.11.2022 को आयोजित 120वीं पीसीसी बैठक का कार्यवृत्त ।

Sub: Minutes of the 120th PCC meeting held on 16.11.2022.

Sir,

16.11.2022 को आयोजित **120वीं** पीसीसी बैठक का कार्यवृत्त पू.क्षे.वि.स. की वेबसाइट (**http://www.erpc.gov.in/**) पर उपलब्ध है । कृपया देखें ।

Please find the minutes of the **120th PCC** meeting of ERPC held on **16.11.2022** available at ERPC website (**http://www.erpc.gov.in/**).

यदि कोई अवलोकन हो, तो कृपया इस कार्यालय को यथाशीध्र भेजा जाए ।

Observations, if any, may please be forwarded to this office at the earliest.

भवदीय / Yours faithfully,

(पी.पी.जेना / P.P.Jena)
Executive Engineer (PS)
कार्यपालक अभियंता(पी.एस)

LIST OF ADDRESSES:

Chief Engineer, Trans (O&M) Bihar State Power Transmission Limited, VidyutBhawan, Bailey Road, Patna-800021	Electrical Supeeerintending Engineer (CRITL) Bihar State Power Transmission Limited, VidyutBhawan,Bailey Road, Patna-800021
Chief Engineer(System Operation), SLDC , BSPTCL, Patna-800021	
Chief Engineer (SLDC) Damodar Valley Corporation, GOMD-I Premises, P.O.- DaneshSeikh Lane, Howrah- 711109	Chief Engineer (CTC) Damodar Valley Corporation, P.O. Maithon Dam, Dist. Dhanbad,Jharkhand-828207
Chief Engineer, (CRITL) Jharkhand UrjaSancharan Nigam Limited Kusai Colony, Doranda, Ranchi-834002	Electrical Superintending Engineer (CLD) Jharkhand UrjaSancharan Nigam Limited, KusaiColony,Doranda, Ranchi-834002
Chief General Manager (O&M), OPTCL, Janpath, Bhubaneswar, Odisha – 751 022. FAX: 0674-2542932 cgm.onm@optcl.co.in	Sr. General Manager (PPA), Technical Wing, OHPCL, Orissa State Police Housing & Welfare Corpn. Bldg. VaniviharChowk, Janpath, Bhubaneswar-752022
Chief Load Dispatcher, SLDC OPTCL, P.O. Mancheswar Rly. Colony Bhubaneswar-751017	Chief Engineer (Testing), WBSETCL Central Testing Laboratory, Abhikshan, Salt Lake, Kolkata-700091 (Fax no. 2367-3578/1235)
Chief Engineer (CLD) WBSETCL, P.O.Danesh Sheikh Lane, AndulRoad, Howrah-711109	Addl. Chief Engineer (ALDC) West Bengal Electricity Distribution Company Ltd VidyutBhavan, 7th Floor, Bidhannagar, Sector-I Salt Lake City, Kolkata-700091(Fax-033-2334-5862)
Dy. Chief Engineer (Testing)/ Sr. Manager (Testing) CESC Ltd.,4, SasiSekhar Bose Road, Kolkata-700025	General Manager (O&M) KhSTPS, NTPC Ltd., P.O.Deepti Nagar, Dist. Bhagalpur, Bihar-813203
General Manager(O&M) FSTPS, NTPC Ltd., P.O. Nabarun, Dist. Murshidabad, West Bengal-742236	Dy. General Manager (Engineering), WBPDCL, OS Dept. Corporate Office, 3/C, LA Block, Salt Lake-III, Kolkata-700098 (Fax-033-23350516)
General Manager (O&M) Barh STPS, NTPC Ltd., P.O. NTPC Barh, Dist. Patna, Bihar-803213	General Manager (OS), ERHQ-II, NTPC Ltd., 3rdflr. OLIC Building, Plot no. N 17/2, Nayapalli, Unit-8 Bhubaneswar- 751012 (Fax No. 0674-2540919)
General Manager(O&M), TSTPS, NTPC Ltd., P.O.Kaniha, Dist. Angul, Orissa-759117	General Manager (AM), POWERGRID, Odisha Projects, Sahid Nagar, Bhubaneswar – 751 007
General Manager (OS), ERHQ-I, NTPC Ltd., LoknayakJaiprakashBhawan, (2nd Floor), DakBunglowChawk, Patna-800001	Manager (Electrical), Adhunik Power & Natural Resources Ltd. "Lansdowne Towers, Kolkata-700020 (Fax No. 033-2289 0285)
Executive Director (O&M) NHPC Ltd., NHPC Office Complex, Sector-33, Faridabad, Haryana-121003 (Fax-01292272413)	Electrical Superintending Engineer, TTPS, TenughatVidyut Nigam Ltd., Lalpania, Dist. Bokaro, Jharkhand-829149
Dy. General Manager (Electrical) IB Thermal Power Station, OPGCL Banhapalli, Dist. Jharsuguda-768234, Orissa	General Manager (AM), ER-I Power Grid Corporation of India Ltd., Alankar Place, Boring Road, Patna-800001
Chief Engineer (Trans.) Power Deptt., Govt. of Sikkim, Gangtok-731010	Sr. Manager (CTMC) Durgapur Projects Limited, Durgapur-713201
Executive Director, ERLDC, POSOCO, Tollygunge, Kolkata-700033	The Head Maithon Power Limited, Maithon Office, MA 5 Gogna, Dist. Dhanbad, Jhankand State, PIN-828207
General Manager (AM), ER-II Power Grid Corporation of India Ltd., J-I-15, Block-EP, Sector-V,Salt Lake,Kolkata-91	Head –Regulatory and contracts, IndiGrid Limited , 247 Embassy, Office No 107, 'B' Wing, Hindustan Co. Bus Stop, Gandhi Nagar, L.B.S. Road, Vikhroli West, Mumbai – 400 079. Ph : +91 845509 96408
General Manager (P&O), PTC Ltd., Kanchanjunga Bldg.,18, Barakhamba Road, New Delhi-110001	
Managing Director, Bhutan Power Corporation Post Box no. 580, Thimpu, Bhutan.	Managing Director, Druk Green Power Corprn. P.O. Box-1351, Thimpu, Bhutan.

Associate Director (Commercial and Regulatory) Darbhanga-Motihari Transmission Company Limited (DMTCL),503, Windsor, Off CST Road, Kalina, Santacruz(E), Mumbai-400098	The Plant Head, JITPL, Angul, Odisha (FAX:011-26139256-65)
Shri D. P. Bhagava, Chief Consultant (O&M), TeestaUrja Limited, New Delhi (FAX:011-46529744)	Director (GM Division), Central Electricity Authority Sewa Bhawan, R. K. Puram, New Delhi-110066
Director (NPC), CEA, NRPC Building, Katwaria Sarai, New Delhi- 110016	President, Dans Energy Pvt. Ltd, 5th Floor, DLF Building No. 8, Tower-C, Gurgaon - 722OO2
Director, Shiga Energy Pw. Ltd., 5th Floor, DLF Building No. 8, Tower-C, Gurgaon - 722OO2	DGM (E&I), HALDIA ENERGY LIMITED, BARIK BHAWAN, KOKATA-700072, FAX: 033-22360955
President , TPTL, BhikajiCama Place, New Delhi , 110066	

Minutes
of
120th PCC Meeting

Date:02/12/2022
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

MINUTES OF 120th PROTECTION COORDINATION SUB-COMMITTEE MEETING HELD ON 16.11.2022 AT 10:30 HOURS THROUGH MS TEAMS ONLINE MEETING PLATFORM

Member Secretary, ERPC chaired the meeting. List of participants is enclosed at **Annexure-A.**

PART – A

ITEM NO. A.1: Confirmation of Minutes of 119th Protection Coordination sub-Committee Meeting held on 18th October 2022 through MS Teams online platform.

The minutes of 119th Protection Coordination sub-Committee meeting held on 18.10.2022 was circulated vide letter dated 09.11.2022.

Members may confirm.

Deliberation in the meeting

Members confirmed minutes of 119th PCC Meeting.

PART – B

ITEM NO. B.1: Repeated Disturbance at 220 kV Chatra(JUSNL) S/s

A. Total Power Failure at 220 kV Chatra(JUSNL) S/s on 13.10.2022 at 10:22 Hrs

220 kV Daltonganj-Chatra-2 is LILOed at Latehar, however, 220 kV Latehar-Chatra is not charged yet.

On 13.10.2022 at 10:22 Hrs, 220 kV Daltonganj-Chatra-1 got tripped due to R_N fault subsequently total power failure occurred at Chatra S/s as it was fed radially through only one circuit.

Load Loss: **17 MW**
Outage Duration: 08:54 Hrs

B. Total Power Failure at 220 kV Chatra(JUSNL) S/s on 17.10.2022 at 10:50 Hrs

On 17.10.2022 at 10:50 Hrs, 220 kV Daltonganj-Chatra-1 got tripped due to B_N fault subsequently total power failure occurred at Chatra S/s as it was fed radially through only one circuit.

Load Loss: **17 MW**
Outage Duration: 00:34 Hrs

C. Total Power Failure at 220 kV Chatra(JUSNL) S/s on 19.10.2022 at 15:09 Hrs

On 19.10.2022 at 15:09 Hrs, 220 kV Daltonganj-Chatra-1 got tripped due to Y_N fault. This resulted in total power failure occurred at Chatra S/s as it was fed radially through only one circuit.

Load Loss: **10 MW**

Outage Duration: 00:37 Hrs

Detailed report from ERLDC is attached at **Annexure B.1**.

JUSNL may explain.

Deliberation in the meeting

It was informed that 220 kV Chatra S/s was being radially fed from Daltonganj S/s through one circuit of 220 kV Daltonganj-Chatra-1. Tripping of this single circuit in any fault had resulted in total power failure at 220 kV Chatra S/s.

- **On 13.10.2022 at 10:22 Hrs**

R phase jumper got damaged in 220 kV Daltonganj-Chatra-1 at 31 km from Daltongunj end which resulted in tripping of 220 kV Daltonganj-Chatra-1. Auto recloser had not operated from Chatra end and as a result there was total power failure at Chatra S/s.

Powergrid representative informed that auto-recloser was successful from Daltongunj end.

- **On 17.10.2022 at 10:50 Hrs**

JUSNL representative informed that on day of incident heavy rain and thunderstorm was reported. At 10:50 Hrs, transient B phase fault developed in 220 kV Daltonganj-Chatra-1 due to lightening subsequently 220 kV Daltonganj-Chatra-1 got tripped and total power failure occurred at Chatra S/s. as it was fed radially through only one circuit. He further added that auto-recloser had not operated from their end.

Autorecloser was successful from Daltonganj end.

- **Total Power Failure at 220 kV Chatra(JUSNL) S/s on 19.10.2022 at 15:09 Hrs**

Y phase CT of 220/132 k V ICT 2 at Chatra end got burst which resulted in Y phase fault. Subsequently 220 kV Daltonganj-Chatra-1 got tripped and total power failure occurred at Chatra S/s.

Regarding auto recloser issue at Chatra end, JUSNL representative replied that the matter has been taken up with the concerned agency for rectification. PCC opined that some of the disturbances could have been avoided had the auto recloser operated successfully from Chatra end. PCC further advised JUSNL to resolve the auto recloser issue within one month.

ITEM NO. B.2: Major grid events other than GD/GI

A. Bus tripping occurred in Eastern Region during October 2022

During October 2022, following incidents of bus bar tripping had been observed in Eastern Region.

Element Name	Tripping Date	Reason	Utility
400 kV Main Bus-1 at Patna	10.10.22 at 15:07 Hrs	LBB of 400 kV Patna-Saharsa-2 operated at Patna	PG ER-1

400 kV Main Bus-1 at Mendhasal	19.10.22 at 16:15 Hrs	During testing of future bay LBB operated.	OPTCL
220 kV Bus-1 at Ramchandrapur	04.10.22 at 21:30 Hrs	Bus bar protection operated	JUSNL
220 kV Bus-2 at Rengali (PH)	07.10.22 at 13:42 Hrs	Bus bar protection operated. Y_ph jumper snapped	OHPC
220 kV Bus-1 at Motipur	19.09.22 at 10:51 Hrs	Bus Bar protection Operated	BSPTCL

Concerned utilities may explain.

Deliberation in the meeting

- ***Tripping of 400 kV Main Bus-1 at Patna on 10/10/2022 at 15:07 Hrs***

Powergrid representative informed that the incident occurred during a line fault in 400 kV Patna-Saharsa-2. To clear the line fault, the relay issue tripping command to both main & tie breakers of Patna-Saharsa-2. Subsequently LBB protection operated for main bay of the line and tripped all the elements connected to bus-1 at Patna S/s.

He added that the incident was later investigated and it was found that due to bad quality of SF6 gas, current conduction occurred across the B pole contacts of main bay circuit breaker which resulted in triggering of LBB protection. He further added that contacts of breaker were also found damaged which was already been replaced.

- ***Tripping of 400 kV Main Bus-1 at Mendhasal on 19/10/2022 at 16:15 Hrs***

OPTCL representative informed that on the day of incident testing of future bay was in progress during which contact of LBB protection of main bus 1 got inadvertently touched and resulted in initiation of LBB protection. Subsequently all the elements connected to 400 kV Main Bus 1 got tripped.

- ***Tripping of 220 kV Bus-1 at Ramchandrapur on 04/10/2022 at 21:30 Hrs***

JUSNL representative informed that on 04/10/2022 at 21:30 Hrs, bus bar protection for 220 kV Bus-1 at Ramchandrapur operated which resulted in tripping of Bus-1. He explained that differential current was observed by bus bar differential relay of Bus-1 without any actual bus fault.

Members opined that CT saturation during through fault might had resulted in differential current in busbar relay. PCC advised JUSNL that knee-point test may be carried out for the associated CTs in order to find out the CT saturation issue and the observation may be shared with ERPC/ERLDC.

- ***Tripping of 220 kV Bus-2 at Rengali(PH) on 07/10/2022 at 13:42 Hrs***

OHPC representative informed following:

- *220 kV TSTPP – Rengali PH feeder and both units of Rengali PH were connected to Bus - 2.*

- *At 13:42 Hrs, Y phase jumper of 220 k V TSTPP – Rengali PH got snapped which resulted in Y phase fault in the line.*
- *Relay at Rengali PH end for 220 kV Rengali-TSTPP line issued trip command however all 3 poles of breaker did not open. Subsequently LBB protection initiated which resulted in tripping of Bus-2 at Rengali.*

On enquiry from PCC regarding reason behind non opening of breaker, OHPC representative informed that communication had been done to M/S GE regarding the matter however no response had been received from them.

Regarding the protection operated for line relay at Rengali PH end for the 220 kV line, OHPC representative could not clarify the matter. The disturbance could not be explained due to non-availability of DR/EL & disturbance report.
PCC advised OHPC/SLDC Odisha to submit the DR/EL of the event immediately and also submit a report w.r.t. the above disturbance.

- ***Tripping of 220 kV Bus-1 at Motipur on 19/09/2022 at 10:51 Hrs***

BSPTCL representative explained that there was a C- phase to Ground fault in 220kV MTPS-Motipur circuit-. The fault was cleared from MTPS end however at Motipur end, while clearing the fault C-phase circuit breaker got stuck and did not open. This resulted in operation of LBB protection and subsequently 220 kV bus-1 got tripped.

During investigation both the trip coils of the breaker was found in burnt condition. He added that the trip coils were replaced & the breaker had been put into service.

ITEM NO. B.3: Repeated Tripping of 132 kV Sonenagar-Nagaruntari

132 kV Sonenagar -Nagaruntari had tripped 13 times in the month of October"22. It has also observed that for each tripping line was restored within a span of one to two hour.

Sr.No	Element Name	Tripping Date	Tripping Time	Reason	Revival Date	Revival Ti
1	132KV-Nagaruntari-SONENAGAR-1	01-11-2022	00:46	Sonenagar end: R-E, Zone - 1, F/C 3.3 kA, 3.7 km. It generally remain idle charged from Sonenagar end.	01-11-2022	02:02
2	132KV-Nagaruntari-SONENAGAR-1	18-10-2022	18:50	Sonenagar: R-N, Ir=2.57 KM, fd=5.245 KM	18-10-2022	22:35
3	132KV-Nagaruntari-SONENAGAR-1	17-10-2022	04:23	Sonenagar: R-E Fault, F/C 2.331 KA, F/D 5.947KM	17-10-2022	05:20
4	132KV-Nagaruntari-SONENAGAR-1	15-10-2022	18:47	Tripped from Sonenagar End only, Sonenagar: R-Ph, Z-4, 2.534 kA,	15-10-2022	19:43
5	132KV-Nagaruntari-SONENAGAR-1	14-10-2022	21:22	Sonenagar: R-N, 2.6kA, -5.3km (backup protection relay), Line was idle charged from Sonenagar end.	14-10-2022	22:10
6	132KV-Nagaruntari-SONENAGAR-1	12-10-2022	21:45	Sonenagar: R-Ph, Z-4,2.687 kA, 25.32 kM. Naruntari: Not Tripped.	12-10-2022	22:33
7	132KV-Nagaruntari-SONENAGAR-1	12-10-2022	05:50	Sonenagar:B-Ph, 2.792 kA, 25.87 kM Nagaruntari: Not Tripped	12-10-2022	06:58
8	132KV-Nagaruntari-SONENAGAR-1	11-10-2022	21:35	Sonenagar End: Z-4, R-ph, 25.3 km, If = 2.693 kA	11-10-2022	23:02
9	132KV-Nagaruntari-SONENAGAR-1	10-10-2022	18:43	SoneNagar - R_N , FC - 0.8 KA	10-10-2022	19:28
10	132KV-Nagaruntari-SONENAGAR-1	08-10-2022	19:50	Sonenagar: Y-E fault, F/C 2.64 KA, F/D 25.2 Km	08-10-2022	21:10
11	132KV-Nagaruntari-SONENAGAR-1	06-10-2022	08:54	Sonenagar: R-E, 2.844KA, Zone-4, 24.23Km	06-10-2022	10:28
12	132KV-Nagaruntari-SONENAGAR-1	04-10-2022	16:14	Sonenagar: R-N, Z-4, 3.725kA, 18.11km	04-10-2022	17:34
13	132KV-Nagaruntari-SONENAGAR-1	03-10-2022	18:23	Sonenagar: RN,	03-10-2022	19:06

JUSNL & BSPTCL may explain.

Deliberation in the meeting

JUSNL representative informed that patrolling was done for 132 kV Sonenagar -Nagaruntari subsequently damaged insulators were found at 4-5 locations which had been replaced on 20th October 2022 after which tripping incidents of line had been reduced.

On enquiry from PCC regarding whether faults had occurred in Bihar or Jharkhand jurisdiction, BSPTCL representative informed that total length of line is 133 km out of which approx. 34 km from Sonenagar end is in BSPTCL jurisdiction and remaining length is under JUSNL jurisdiction.

It was observed that most of faults had occurred at 24-25 km from Sonenagar end which is under BSPTCL jurisdiction. BSPTCL representative added that tower top patrolling was carried out and damaged insulators were found at certain locations. The damaged insulators had been replaced on 19th and 20th October 2022 after which no tripping had been observed.

PCC advised JUSNL and BSPTCL to rectify all clearance issues present in line and replace all faulty insulators at the earliest.

ITEM NO. B.4: Spurious tripping of ICTs

Please find below details of tripping of ICTs where protection system had mal-operated.

Sr.No	Element Name	Tripping Date	Tripping Time	Reason
1	400KV/220KV 315 MVA ICT 2 AT MENDHASAL	19-10-2022	16:15	During testing of 413 future bay at Mendhasal, LBB got initiated
2	400KV/220KV 315 MVA ICT 1 AT MENDHASAL	19-10-2022	16:15	During testing of 413 future bay at Mendhasal, LBB got initiated
3	400KV/220KV 315 MVA ICT 1 AT KEONJHOR(PG)	15-10-2022	12:35	DC earth fault.
4	400KV/220KV 315 MVA ICT 1 AT JAMSHEDPUR	14-10-2022	05:29	Mal Operation of relay
5	400KV/220KV 315 MVA ICT 1 AT MEERAMUNDALI	04-10-2022	22:21	OTI Operated
6	400KV/220KV 315 MVA ICT 1 AT JAMSHEDPUR	04-10-2022	21:30	Tripped from Ramchandrapur end.
7	400KV/220KV 315 MVA ICT 2 AT JAMSHEDPUR	04-10-2022	21:30	Tripped from Ramchandrapur end.

Concerned utility may explain.

Deliberation in the meeting

- ***Tripping of 400/220kV 315 MVA ICT 2 and 315 MVA ICT 1 at Mendhasal on 19-10-2022 at 16:15 Hrs***

OPTCL representative informed that prior to incident both ICTs at Mendhasal were connected at Bus 2. At 16:15 Hrs, during tripping of 400 kV Main Bus-1 at Mendhasal, tripping command of LBB was extended to tie breaker LBB of ICT bays and as a result tie breaker LBB operated and subsequently both ICTs got tripped.

He informed that the incident occurred due to wrong LBB logic in the relay and the same had been rectified in consultation with relay engineer.

- ***Tripping of 400/220kV 315 MVA ICT 1 at Keonjhor on 15-10-2022 at 12:35 Hrs***

Powergrid representative informed that no physical fault was found for tripping of ICT. He further informed that cable healthiness and other testing was also done and no abnormality was reported.

He added that on day of incident, DC earth fault was observed in substation momentarily Which might have caused tripping of ICT.

- ***Tripping of 400/220kV 315 MVA ICT 1 at Jamshedpur on 14-10-2022 at 05:29 Hrs***

Powergrid representative informed that the ICT tripped on spurious operation of differential relay. The relay observed differential current though there was no fault at the time of disturbance.

He further informed that the faulty relay had been replaced with spare relay.

- ***Tripping of 400/220kV 315 MVA ICT 1 and 315 MVA ICT 2 at Jamshedpur on 04-10-2022 at 21:30 Hrs***

Powergrid representative informed that the ICTs got tripped from Ramchandrapur end & there was no tripping from their end.

JUSNL representative informed that these two ICT s had tripped during the event of 220 kV main bus-1 tripping at Ramchandrapur.

- ***Tripping of 400/220kV 315 MVA ICT 1 at Meeramundali on 04-10-2022 at 22:21 Hrs***

OPTCL representative informed that on day of incident, heavy rain and thunderstorm was reported at site. Due to heavy rain, water ingress took place in marshalling box of ICT and subsequently tripping occurred for 315 MVA ICT-1. He added that door of marshalling box was inadvertently kept open which led to ingress of water. He submitted that due precaution would be followed in future to avoid such type of incidents.

MPL representative informed that in order to avoid tripping due to water ingress they had kept contacts of all mechanical relays like Buchholz, OTI, PRV etc. in a IP65 box within the bay marshalling box to avoid spurious operation of the relays due to moisture ingress.

ITEM NO. B.5: Tripping Incidence in month of October-2022

Single line tripping incidents in the month of October-2022 which needs explanation from constituents of either end is attached.

Concerned utilities may explain.

Deliberation in the meeting

Members explained the tripping incidences. The updated status is enclosed at ***Annexure B.5.***

PART- C :: OTHER ITEMS

ITEM NO. C.1: Follow-up of Decisions of the Previous Protection Sub-Committee Meeting(s)

The decisions of previous PCC meetings are attached.

Members may update the latest status.

Deliberation in the meeting

*Updated status for decisions of previous PCC meetings is given at **Annexure C.1**.*

ITEM NO. C.2: DEF protection setting review in Sikkim complex in view of LILO of 400 kV Teesta 3-Kishanganj at Rangpo

After LILO of 400 kV Teesta 3-Kishanganj at Rangpo, review of DEF settings for all lines emanating from Teesta-3, Dikchu, Rangpo was necessitated. In 111th PCC meeting, it was decided that PRDC would carry out the study for DEF relay setting coordination for Sikkim Complex with revised configuration of transmission network.

Subsequently the study was carried out and shared with ERLDC for verification of network configuration and fault level data.

In 117th PCC meeting ERLDC observed that the network configuration and fault level information are in order.

The DEF settings based on the revised study is enclosed at **Annexure C.2.**

In 118th PCC Meeting, PCC advised concerned utilities of Sikkim Complex to implement the revised settings of DEF relay as enumerated in the report at their respective end and confirmation of the same shall be intimated to ERPC/ERLDC.

In 119th PCC Meeting, it was informed that Tashiding had revised the DEF settings at their end.

PCC advised concerned utilities to implement the revised DEF settings at their end at the earliest.

Concerned utilities may update.

Deliberation in the meeting

PCC advised concerned utilities to implement the revised DEF settings at their end at the earliest.

ITEM NO. C.3: Status of Implementation of bus bar protection at 220 kV Substations.

The issue was raised in 45th& 46th TCC Meeting wherein concerned utilities replied that the implementation of busbar protection would be done at the earliest.

In 46th TCC Meeting,

BSPTCL representative updated that out of twelve substations where busbar protection is not available, proposal for ten no of substations has been sent for funding through PSDF.
Busbar protection of Fatuha S/s will be commissioned in August'22. For Biharsharif S/s, there is space constraint and the busbar protection can be implemented after construction of new control room building.
OPTCL representative informed that some of the substations where busbar is not-operational are under SAS project and the commissioning of busbar is covered under the SAS project. For these substations, the tentative timeline for implementation would be one year.

TCC opined that the requirement of having busbar protection in 220 kV substations is mandatory as per CEA grid connectivity standard and advised concerned transmission utilities to take necessary action for operationalizing busbar protection in all the 220 kV substations in their respective jurisdiction.

In 119th PCC Meeting, OPTCL representative informed that bus bar protection of nine(9) substations where it was not operational earlier had been rectified and is in healthy state at present.

PCC advised OPTCL to share status of bus bar protection of all 220 kV substations to ERPC/ERLDC.

WBSETCL representative informed that bus bar protection at Gokarna and Satgachia S/S is not in service due to pending stability test and it will be put into service by Nov 2022.

JUSNL representative informed that bus bar protection at Chaibasa S/s is not in service at present.

Concerned utilities may update the present status.

Deliberation in the meeting

There was no further update in the status of the busbar protection. The list is enclosed at ***Annexure C.3.***

ITEM NO. C.4: Review of utilization of PSCT/PDMS by the utilities of ERPC

Under the PSDF funded project "Creation and maintaining a Web based Protection Database and Desktop based Protection setting calculation tool for Eastern Regional Grid" a centrally available web-based protection database was in operation since 2017. As per the DPR of the project, the project would have five-year support service period after Go-Live of the project. Presently the 5th year support service is going on which will be completed on 31.10.2022. Also, 32 nos. of PSCT licenses were distributed among the ER utilities to carry out protection studies, relay co-ordinations, tripping analysis etc. under the above project.

To decide further course of action regarding protection database, it is necessary to review/discuss the utilization of the protection database as well as PSCT licenses by the utilities of Eastern Region. Utilities may share their experience and give feedback/suggestion on ER Protection database system.

In 119th PCC meeting, Member secretary ERPC stressed upon fact that in spite of training on PSCT and PDMS provided at regular interval, the protection settings/relay data are not being added/updated by most of the utilities in the protection database. He informed that under proposed IEGC regulation 2022, protection database has been mandated to be maintained at RPC level. He requested all the utilities of Eastern Region to take necessary steps in this regard so that whenever there is an addition/change in relay setting/protection settings in their respective system, the same shall be updated in protection database of ERPC(PDMS). This will ensure an up-to-date protection

database. He further suggested that a modus operandi may be prepared in consultation with ERLDC & other concerned utilities for timely update of the settings data into the database.

With regard to PSCT license, he requested all the utilities to share their utilization as well as feedback on the software.

PCC advised all utilities to share their experience and provide feedback/suggestion on ER Protection database system as well as PSCT tool to ERPC secretariat within 15 days.

Member Secretary ERPC also suggested that nodal person from each utility may be nominated who will be responsible for protection related matter including the updation of relay setting in protection database. Further for state transmission system, SLDCs shall monitor the timely submission 7 update of protection settings in database.

Members may update.

Deliberation in the meeting

P*CC advised all utilities to share their experience and provide feedback/suggestion on ER Protection database system as well as PSCT tool, if any, to ERPC secretariat.*

PCC further advised all utilities to nominate one nodal person from each of their organisation who will be responsible for updation of relay/protection setting in protection database and associated matter w.r.t the database.

ITEM NO. C.5: Compliance of 3rd Party Protection Audit Team Observations

3rd party protection audit of various substations in Odisha was carried out from 25.04.2022 to 28.04.2022 by audit team. The observation of audit team is attached at **Annexure C.5.1.**

In 117th PCC meeting, NTPC Darlipalli representative informed that the recommendation regarding overvoltage settings have already been complied with and for power swing blocking setting, the matter has been sent to their corporate wing for their comments.

In 118th PCC Meeting, OPTCL vide email dated submitted their compliance.

3rd party protection audit observations for the substations in Jharkhand has been circulated vide letter dated 19.09.2022. The report is enclosed at **Annexure C.5.2**. PCC advised JUSNL, Powergrid & DVC to go through the observations and take necessary action for compliance.

In 119th PCC Meeting, JUSNL representative informed that approval had been taken from higher authority for compliance of 3rd party protection audit observations for the substations in Jharkhand.

PCC advised Powergrid & DVC to go through the observations and take necessary action for compliance and share updated status of compliance of 3rd party protection audit observations to ERPC.

Concerned utilities may update.

Deliberation in the meeting

PCC advised Powergrid & DVC to submit the updated status with respect to the compliance of 3rd party protection audit observations.

ITEM NO. C.6: List of works carried out by PRDC Pvt. Ltd. during the period of November 2021 to October 2022

The Protection Database project has been implemented by PRDC and declared “Go Live” on 31st October, 2017. In continuation to above, PRDC submitted report for verification of works carried out during the period of November, 2021 to October, 2022. PRDC may present. Members may discuss.

PRDC may present. Members may discuss.

Deliberation in the meeting

PRDC representative explained the work done by PRDC in 5th support period with help of presentation which is attached at ***Annexure C.6.***

She informed that for all the new substations visited, the data as collected from substation was updated in protection database.

Regarding new elements addition as updated in OCC Meeting, she informed that few data had been received from JUSNL, Powergrid and OPTCL however they had not received data from other utilities. The list of elements for which data is yet to be received has already been shared with concerned utilities.

PCC advised concerned utilities to go through the PRDC presentation and verify the settings of the visited substation in the database. Further concerned utilities were requested to submit the pending protection settings data so that the same can be updated in the database.

****

List of Participants in 120th PCC Meeting held on 16/11/2022 at 10:30 am

Annexure A

Name	First join	Email
ERPC Kolkata	16/11/22, 10:15:20 am	ERPC@KolkataMST.onmicrosoft.com
TEESTA-III VIJAY CHANDRA	16/11/22, 10:15:31 am	
rajendra prasad	16/11/22, 10:15:32 am	
NIRMAL MONDAL (WBSETCL) (Guest)	16/11/22, 10:20:37 am	
Chandan kumar	16/11/22, 10:21:18 am	chandan@erldc.onmicrosoft.com
SMS SAHOO, DGM(ELECT),OOTCL, BHUBANES\	16/11/22, 10:22:20 am	
Alok Pratap Singh	16/11/22, 10:22:21 am	apsingh@erldc.onmicrosoft.com
Hareesh Puthiyadath	16/11/22, 10:24:29 am	hareesh.p@greenkogroup.com
EMR OPTCL Bhubaneswar	16/11/22, 10:25:43 am	
Somnath Chatterjee	16/11/22, 10:27:07 am	schatterjee@tatapower.com
SLDC,ODISHA (Guest)	16/11/22, 10:27:29 am	
JAGANATH PANI	16/11/22, 10:29:00 am	
Dilshad Alam, BSPTCL	16/11/22, 10:29:58 am	
Deepak Kumar Singh (Guest)	16/11/22, 10:30:51 am	
Shadab	16/11/22, 10:31:02 am	
Rahul Anand	16/11/22, 10:31:23 am	RAHULANAND@NTPC.CO.IN
Dilip kant jha EEE	16/11/22, 10:31:42 am	
Biswaranjan Mohanty	16/11/22, 10:31:51 am	
EEE	16/11/22, 10:32:02 am	
Amalendu Nanda	16/11/22, 10:32:07 am	amalendu.nanda@opgc.co.in
Saurav Kr Sahay	16/11/22, 10:32:11 am	saurav.sahay@erldc.onmicrosoft.com
Akash Modi	16/11/22, 10:32:42 am	
Shyamal Konar	16/11/22, 10:32:48 am	konar_s@erldc.onmicrosoft.com
RAHUL KUMAR	16/11/22, 10:33:07 am	
Akash Kumar Modi	16/11/22, 10:33:14 am	akmodi@erldc.onmicrosoft.com
BDK	16/11/22, 10:33:35 am	
KUMAR AMRENDRA MADANPURI	16/11/22, 10:33:38 am	
suraj	16/11/22, 10:34:04 am	
Sougato Mondal	16/11/22, 10:34:08 am	saugato@erldc.onmicrosoft.com
EMR OPTCL	16/11/22, 10:34:26 am	
critl bsptcl	16/11/22, 10:35:05 am	
gaurav	16/11/22, 10:35:22 am	

jitesh kumar	16/11/22, 10:35:47 am	
Rambaboo Singh	16/11/22, 10:36:00 am	
Benudhar Pradhan	16/11/22, 10:36:34 am	
MM Sharma TEESTA III 1200MW (Guest)	16/11/22, 10:37:05 am	
Sudeep Kumar, ER1	16/11/22, 10:37:33 am	
Rajib Sutradhar	16/11/22, 10:37:37 am	rajibsutradhar@erldc.onmicrosoft.com
Sarfraj Akhtar Critl Bsptcl	16/11/22, 10:39:17 am	
Ankur Kumar	16/11/22, 10:39:30 am	
shanker	16/11/22, 10:39:56 am	
Dharm Das Murmu, CRITL	16/11/22, 10:39:59 am	
MITHUN GAYEN	16/11/22, 10:40:12 am	mithgyn93@outlook.com
"prabhat kumar (TPTL) (Guest)	16/11/22, 10:42:24 am	
AEE Latehar	16/11/22, 10:42:39 am	
Ramchandrapur jusnl	16/11/22, 10:42:46 am	
Bilash Achari	16/11/22, 10:42:50 am	bilash.achari@erldc.onmicrosoft.com
Debdas Mukherjee WBPDCL (Guest)	16/11/22, 10:43:28 am	
Arindam bsptcl	16/11/22, 10:43:42 am	
DGM,JAJPUR_ROAD.OPTCL	16/11/22, 10:44:05 am	
Baptcl	16/11/22, 10:45:31 am	
Deepak Varma	16/11/22, 10:45:35 am	
Pravin Ram	16/11/22, 10:46:53 am	
Ch Mohan Rao	16/11/22, 10:47:41 am	
Saibal Ghosh	16/11/22, 10:48:07 am	saibal@erldc.onmicrosoft.com
PATRALI	16/11/22, 10:49:09 am	
sk	16/11/22, 10:49:32 am	
kesinga	16/11/22, 10:50:19 am	
Sr. Manager Daltonganj	16/11/22, 10:50:56 am	
DGM E&MR DIV. JAJP	16/11/22, 10:51:08 am	
Dharm Das Murmu, CRITL	16/11/22, 10:51:32 am	
Pravin Ram	16/11/22, 10:52:25 am	
Ravi	16/11/22, 10:53:55 am	
Nishant Kumar Shankwar	16/11/22, 10:56:10 am	Nishant.Kumar@energy-sel.com
aditya jha	16/11/22, 10:57:00 am	

Boni Dhananjay (Guest)	16/11/22, 10:59:03 am	
Ajay Majhi (Guest)	16/11/22, 10:59:38 am	
BALANGIR OPTCL	16/11/22, 11:00:13 am	
D.PATEL OPTCL EMR MERAMUNDALI	16/11/22, 11:03:45 am	
ABAKASH ADHIKARY	16/11/22, 11:04:29 am	abakash.adhikary@dvc.gov.in
Brajesh Kumar	16/11/22, 11:05:16 am	
ASHISH KUMAR	16/11/22, 11:07:26 am	
Shabari Pramanick	16/11/22, 11:14:12 am	shabari.pramanick@erldc.onmicrosoft.com
balangir optcl	16/11/22, 11:15:04 am	
Critl	16/11/22, 11:18:07 am	
Amresh Prusti	16/11/22, 11:22:47 am	amresh.prusti@opgc.co.in
Pritam Mukherjee	16/11/22, 11:24:09 am	pritam@erldc.onmicrosoft.com
Sudipta ranjan Nayak	16/11/22, 11:27:35 am	
CRITL,JUSNL	16/11/22, 11:29:43 am	
Sayan Sarkar (Guest)	16/11/22, 11:43:05 am	
Bolangir OPTCL	16/11/22, 12:19:27 pm	
deepak	16/11/22, 12:39:43 pm	
Kumar Niraj		nirajkumar@tatapower.com

पावर सिस्टम ऑपरेशन करपोरेशन लिमिटेड
(भारत सरकार का उद्यम)
POWER SYSTEM OPERATION CORPORATION LIMITED
(A Government of India Enterprise)
Eastern Regional Load Despatch Centre: 14, Golf Club Road, Tollygunge, Kolkata-700 033.
CIN: U40105DL2009GOI188682
फ़ोन: 033- 24235755, 24174049 फैक्स : 033-24235809/5029 Website:www.erldc.org, Email ID- erldc@posoco.in

दिनांक: **01-11-2022**

Report on the grid event in Eastern Region (पूर्वी क्षेत्र में ग्रिड घटना पर रिपोर्ट)

Summary of the events (घटनाओं का सारांश):

Event 1: At 10:22 Hrs on 13.10.2022, 220 kV Daltonganj-Chatra-1 tripped due to R_N fault. Total power failed at Chatra S/s as it is being fed radially through only one circuit. 220 kV Daltonganj-Chatra-2 is LILOed at Latehar, however, 220 kV Latehar-Chatra is not charged yet. 17 MW load loss reported at Chatra by Jharkhand SLDC.

- **Date / Time of disturbance:** 13-10-2022 at 10:22 hrs
- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Chatra
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 17 MW load loss reported during the event at Chatra by Jharkhand SLDC.

Important Transmission Line/element if out (महत्वपूर्ण संचरण लाइने जो बंद है):

- 220 kV Latehar-Chatra (part section of LILO of 220 kV Daltonganj-Chatra-2 at Latehar)

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Daltonganj-Chatra-1

Relay indication and PMU observation (रिले संकेत और पीएमयू पर्यवेक्षण):

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
10:22	220 kV Daltonagnj-Chatra-1	Daltonganj: R_N, 29.5 km, 3.09 kA, A/r successful	Chatra: R-N, 0.217 kA, 125 km	46 kV dip in R_ph voltage at Daltonganj. Fault clearance time: 100 msec

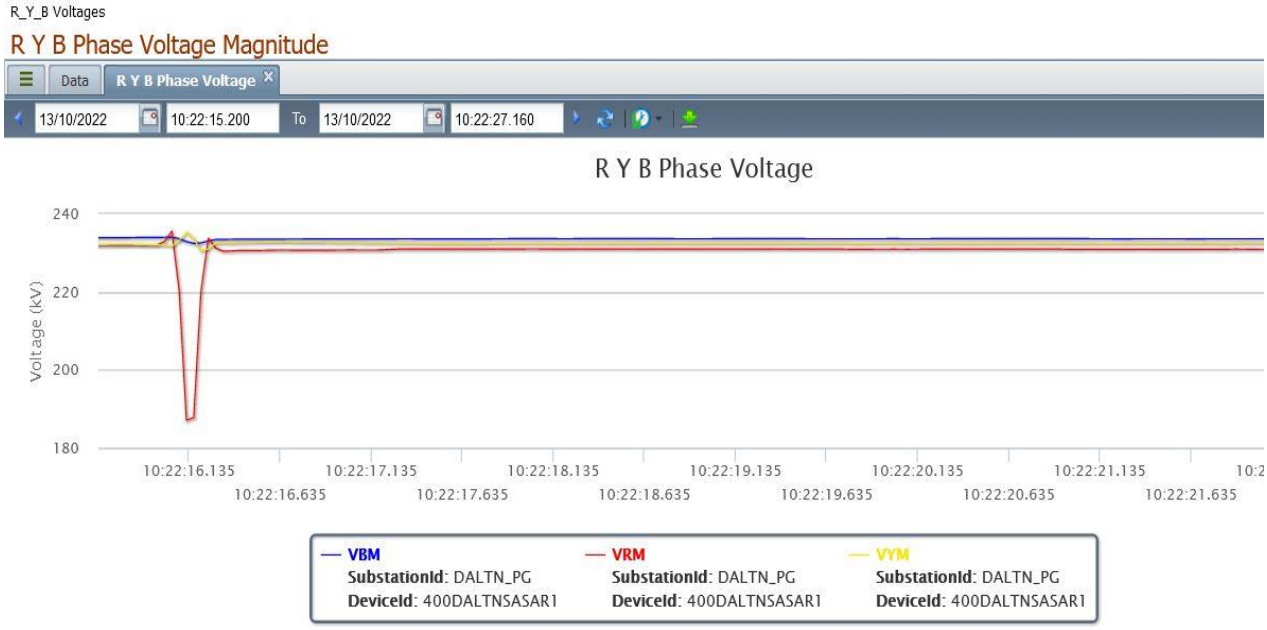


Figure 1: PMU snapshot of 400/220 kV Daltonganj S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Daltonganj-Chatra-1	19:16

Event 2: At 10:50 Hrs on 17.10.2022, 220 kV Daltonganj-Chatra-1 tripped due to B_N fault. Total power failed at Chatra S/s as it is being fed radially through only one circuit. 220 kV Daltonganj-Chatra-2 is LILOed at Latehar, however, 220 kV Latehar-Chatra is not charged yet. 17 MW load loss reported at Chatra by Jharkhand SLDC.

- **Date / Time of disturbance:** 17-10-2022 at 10:50 hrs
- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Chatra
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 17 MW load loss reported during the event at Chatra by Jharkhand SLDC.

Important Transmission Line/element if out (महत्वपूर्ण संचरण लाइने जो बंद है):

- 220 kV Latehar-Chatra (part section of LILO of 220 kV Daltonganj-Chatra-2 at Latehar)

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Daltonganj-Chatra-1

Relay indication and PMU observation (रिले संकेत और पीएमयू पर्यवेक्षण):

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
10:50	220 kV Daltonagnj-Chatra-1	Daltonganj: B_N, 172 km, 1.1 kA, A/r successful	-	21 kV dip in B_ph voltage at Daltonganj. Fault clearance time: 100 msec

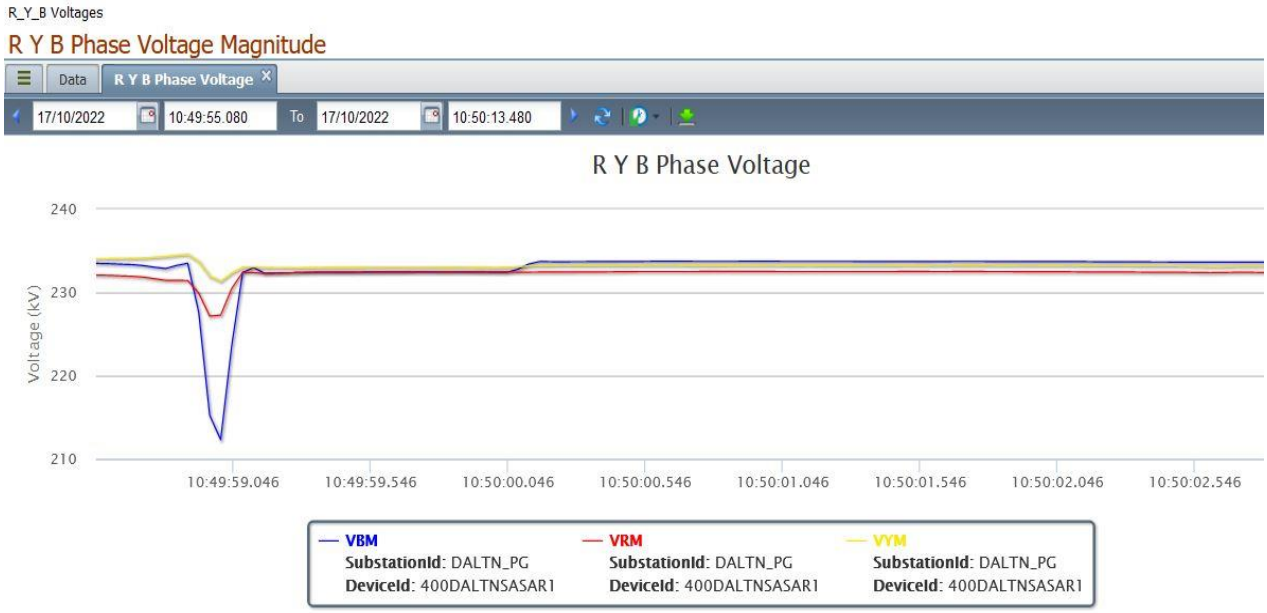


Figure 2: PMU snapshot of 400/220 kV Daltonganj S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Daltonganj-Chatra-1	11:24

Event 3: At 15:09 Hrs on 19.10.2022, 220 kV Daltonganj-Chatra-tripped due to Y_N fault. Total power failed at Chatra S/s as it is being fed radially through only one circuit. 220 kV Daltonganj-Chatra-2 is LILOed at Latehar, however, 220 kV Latehar-Chatra is not charged yet. 10 MW load loss reported at Chatra by Jharkhand SLDC.

- **Date / Time of disturbance:** 19-10-2022 at 15:09 hrs
- **Event type:** GD-1
- **Systems/ Subsystems affected:** 220/132 kV Chatra
- **Load and Generation loss**.
    - No generation loss was reported during the event.
    - Around 10 MW load loss reported during the event at Chatra by Jharkhand SLDC.

Important Transmission Line/element if out (महत्वपूर्ण संचरण लाइने जो बंद है):

- 220 kV Latehar-Chatra (part section of LILO of 220 kV Daltonganj-Chatra-2 at Latehar)

Major elements tripped (प्रमुख ट्रिपिंग):

- 220 kV Daltonganj-Chatra-1

Relay indication and PMU observation (रिले संकेत और पीएमयू पर्यवेक्षण):

समय	नाम	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	पीएमयू पर्यवेक्षण
15:09	220 kV Daltonagnj-Chatra-1	Daltonganj: Y_N, Zone-2, 139.5 km, 1.406 kA	Chatra: Didn't trip	33 kV dip in Y_ph voltage at Daltonganj. Fault clearance time: 400 msec

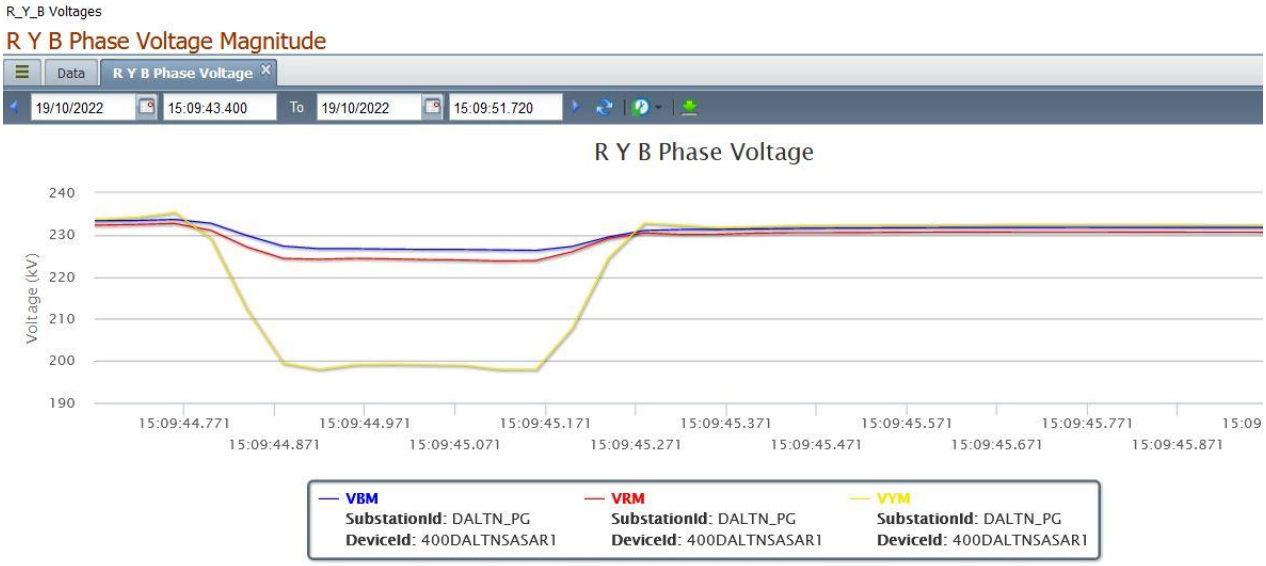


Figure 3: PMU snapshot of 400/220 kV Daltonganj S/s

Restoration (पूर्वावस्था की प्रप्ति)

Transmission/Generation element name	Restoration time
220 kV Daltonganj-Chatra-1	15:46

Network across the affected area (प्रभावित क्षेत्र का नक्शा)

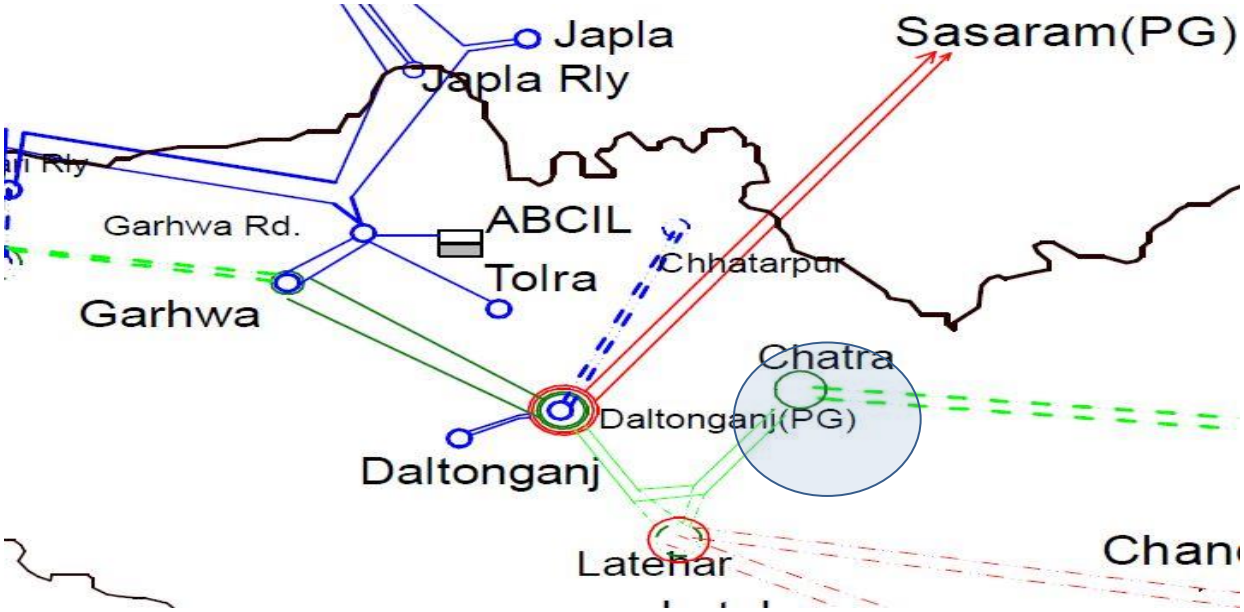


Figure 4: Network across the affected area

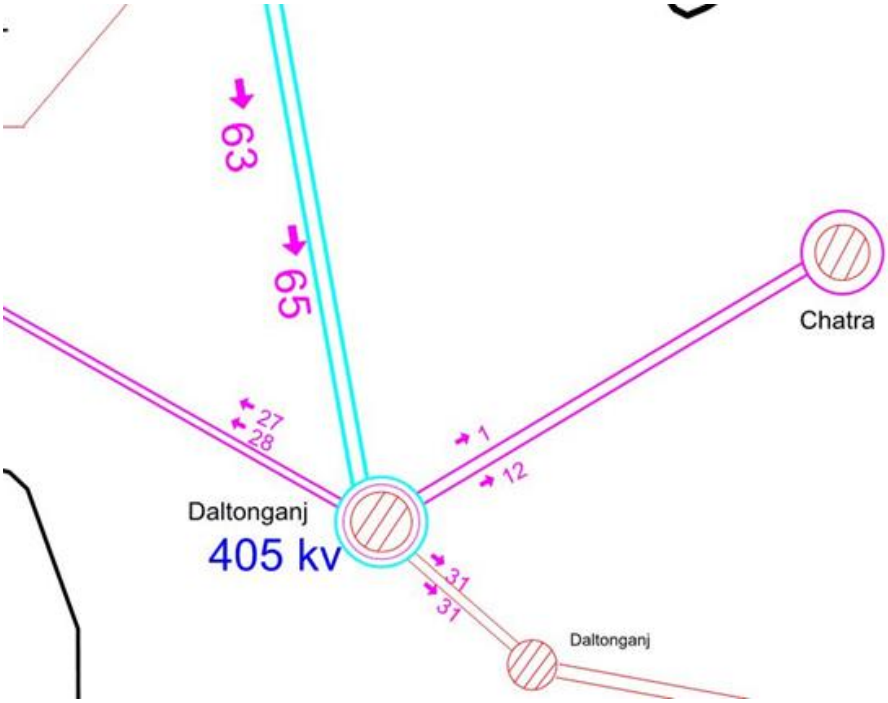


Figure 5: SCADA snapshot of the system

Analysis of the event (घटना का विश्लेषण) & Protection issue (सुरक्षा समस्या):

- In 1st and 2nd event, A/r was successful from Daltonganj only. Issue of Non-A/r at Chatra end has been flagged multiple times. JUSNL may update.
- In 3rd event, fault was cleared from Daltonganj in Zone-2 time, suggesting failure of carrier protection. JUSNL may explain.
- Both LILO portions of 220 kV Daltonganj-Chatra-2 at Latehar has not been charged yet, hence affecting reliability of power supply at Chatra. JUSNL to explain the reason for delay in charging of the line.

Non-compliance observed (विनियमन का गैर-अनुपालन):

Issues	Regulation Non-Compliance	Utility
DR/EL not provided within 24 Hours	1. IEGC 5.2 (r) 2. CEA grid Standard 15.3	**PG ER-1, JUSNL**

Status of Reporting (रिपोर्टिंग की स्थिति):

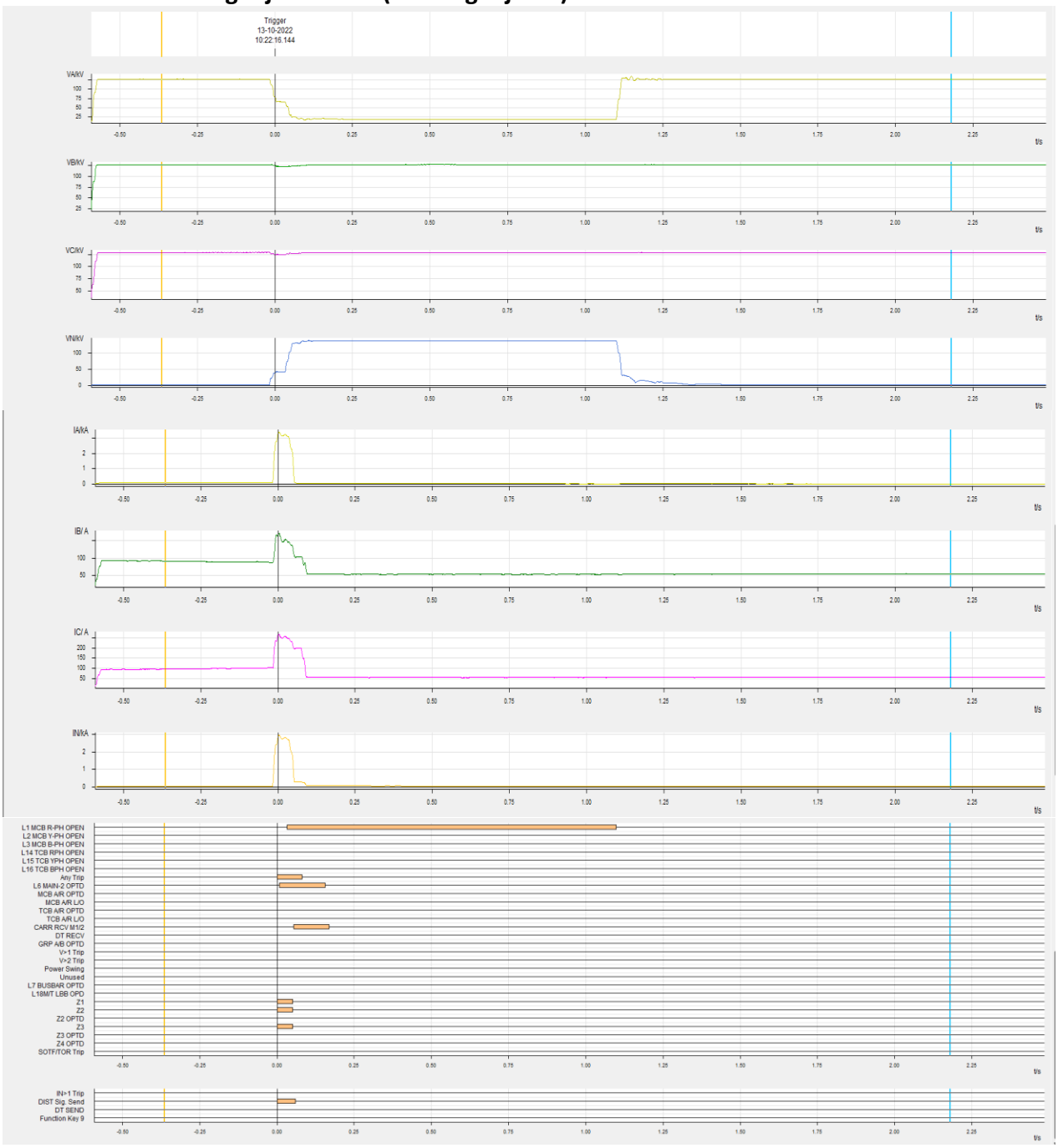
- DR yet to be received from JUSNL

Annexure 1: Sequence of events recorded at ERLDC SCADA data at the time of the event.

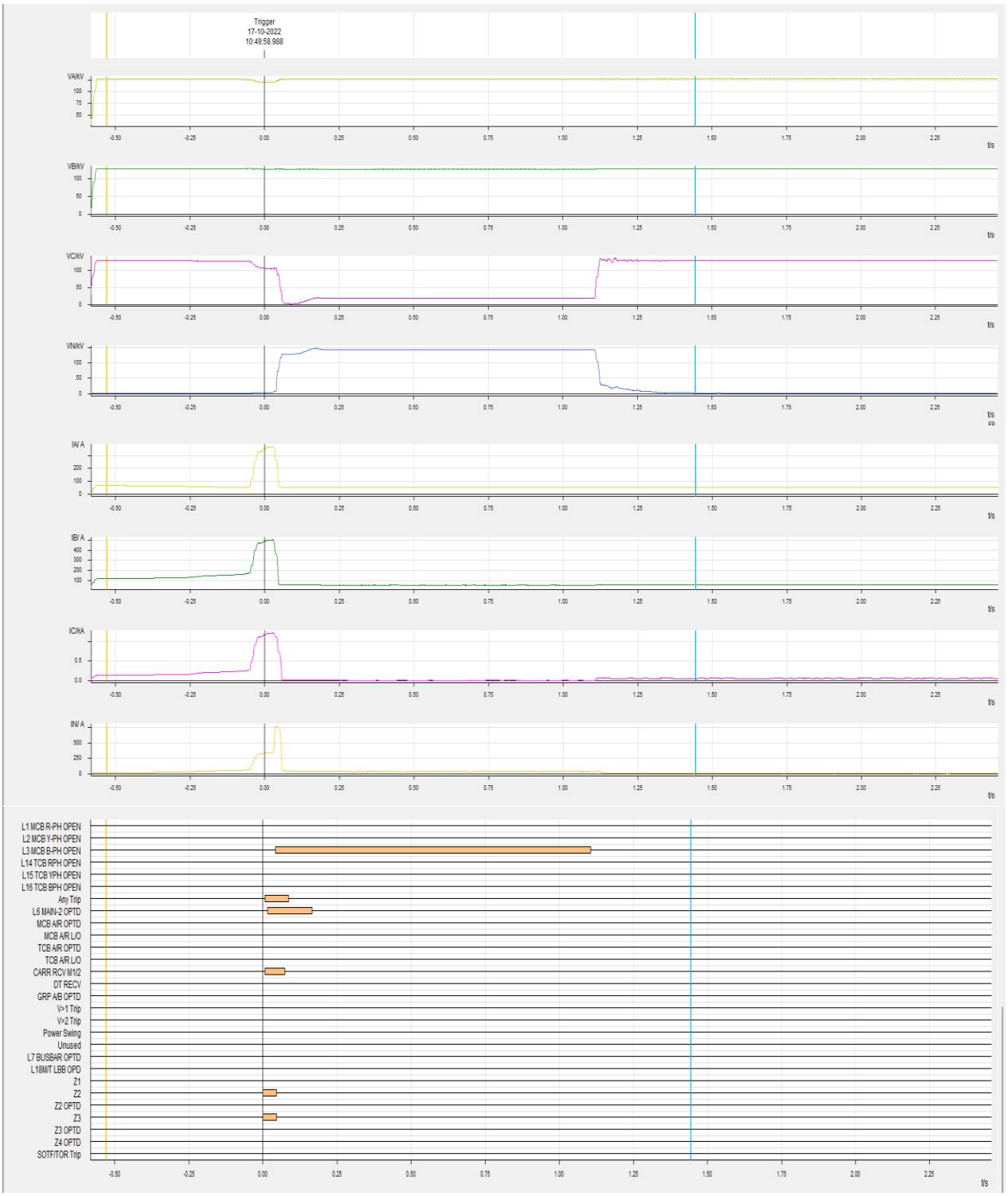
SoE data not recorded at the time of events.

Annexure 2: DR recorded

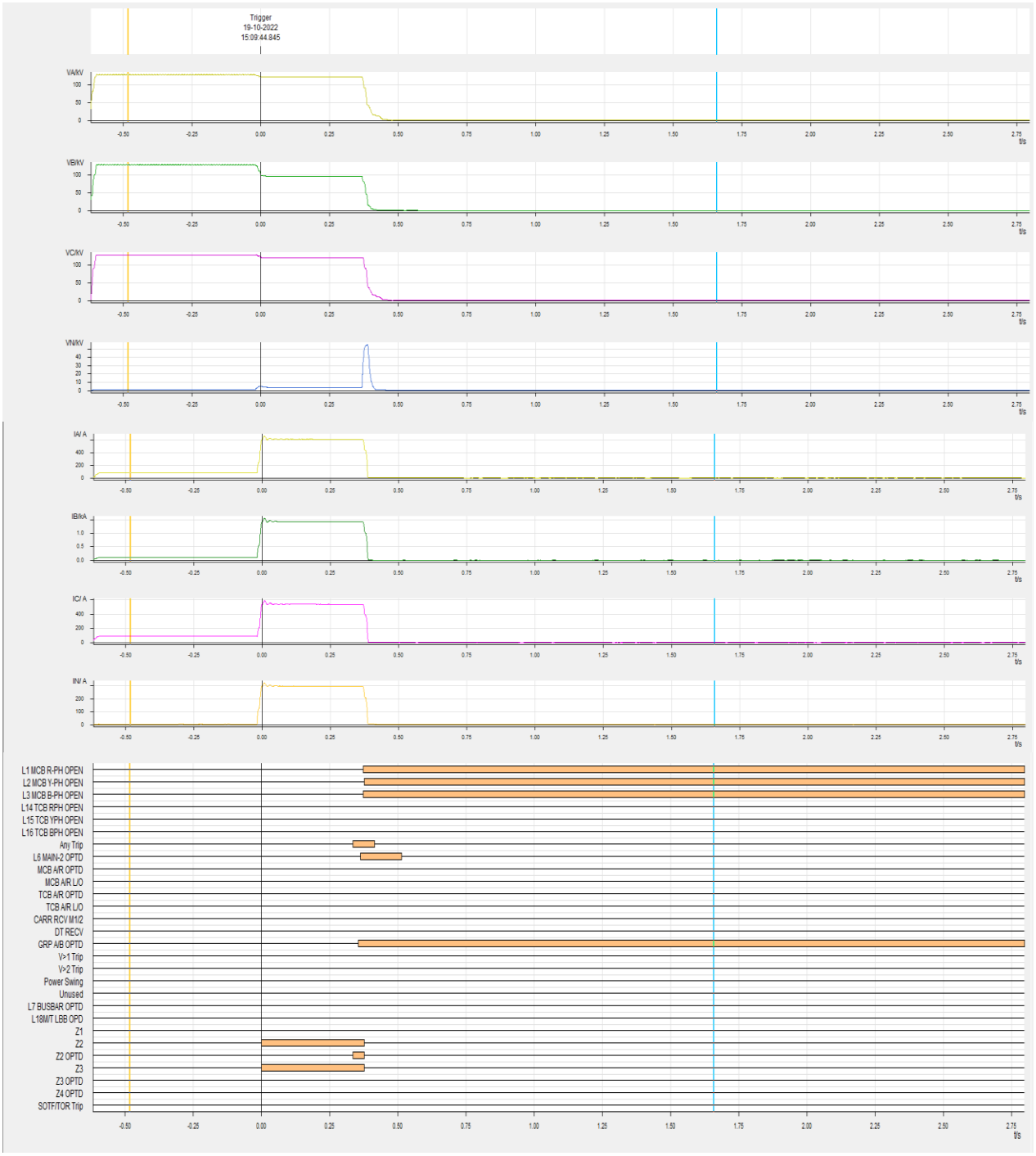
DR of 220 kV Daltonganj-Chatra-1 (Daltonganj end)-Event 1



DR of 220 kV Daltonganj-Chatra-1 (Daltonganj end)-Event 2



DR of 220 kV Daltonganj-Chatra-1 (Daltonganj end)-Event 3



List of important transmission lines in ER which tripped in October-2022

Sl. No.	LINE NAME	TRIP DATE	TRIP TIME	RESTORATION DATE	RESTORATION TIME	Relay Indication LOCAL END	Relay Indication REMOTE END	Reason	Fault Clearance time in msec	Remarks	DR Configuration Discrepancy	DR/ELRECEIVED FROM LOCAL END	DR/ELRECEIVED FROM REMOTE END	UTILITY RESPONSE
1	220 KV DARBHANGA(DMTCL)-DARBHANGA-1	03-10-2022	22:59	04-10-2022	00:10	DMTCL: R_N, 232 km, 0.986 kA, Zone-3		R-Earth	3000			Yes	No	132 kv Line was on B/C and DP setting was incorrect also E/F relay was faulty which has been rectified .ICT O/C will be co-

														ordinated and breaker timimng test will be checked.
2	220 KV DARBHANGA(DMTCL)-DARBHANGA-2	03-10-2022	22:59	04-10-2022	00:10	DMTCL: R_N, Zone-3, 142.7 km, 1.42 kA		R-Earth	3000	Back-Up O/c operated at DMTCL. Fault in downstream, 132 kV Darbhanga-Madhubani line and breaker at Darbhanga didn't open. BSPTCL may explain		Yes	No	
3	400 KV BARH-PATNA-1	04-10-2022	01:00	04-10-2022	01:25	Barh: Y_N, 2.13 km, 23.25 kA	Patna: Y_N, 75 km, 6.3 kA, A/r successful	Y-Earth	100	Three phase tripping at Barh		Yes	Yes	TCB A/R lockout.RECTIFIED.
4	220 KV JODA-RAMCHANDRAPUR-1	04-10-2022	21:30	04-10-2022	23:08	Joda: B_N, 129 km, 0.911 kA	Ramchandrapur: B_N, 7.1 km, 12.75 kA	B-Earth	400	Tripped in Zone-2 time from Joda		Yes	Yes	PLCC unhealthy.
5	400 KV BARIPADA-KEONJHOR-1	05-10-2022	09:57	05-10-2022	11:45	Baripada: DT received	Keonjhor: O/V St. 1	No fault	NA	O/V in B_ph at Keonjhor. Voltage around 429 kV as per PMU		Yes	Yes	Faulty Cable replaced from CVT MB to relay
6	220 KV ROURKELA-TARKERA-2	05-10-2022	12:23	05-10-2022	14:56	Rourkela: B_N, 2.5 km, 14.98 kA	Tarkera: B_N, 10.5 km	B-Earth	100	Other two phase at Rourkela tripped after 1.2 seconds. Three phase tripping at Tarkera		Yes	Yes	Due to carrier fail, AR relay inhibited 3-ph tripping.

7	220 KV ROURKELA-TARKERA-1	05-10-2022	12:38	05-10-2022	14:58	Rourkela: R_N, 12.4 km, 7.37 kA	Tarkera: R_N, 4.3 kA	R-B-Earth	100	Phase to phase fault at Rourkela. Tarkera end observed single phase fault in R_ph		Yes	Yes	Tripped on overload protection after tripping of Tarkera-2 on protection operation.
8	400 KV KAHALGAON-LAKHISARAI-2	05-10-2022	14:43	05-10-2022	19:04	Kahalgaon: Didn't trip		No fault	NA	PRV relay of its line reactor mal-operated due to moisture ingress at Lakhisarai. PG may explain		No	Yes	PRV relay of its line reactor mal-operated due to moisture ingress at Lakhisarai
9	400 KV PATNA-SAHARSA-2	10-10-2022	15:07	10-10-2022	21:41	Patna: B_N, 21.28 km, 12.73 kA	Saharsa: B_N, 218 km, 2 kA	B-Earth	100	Line tripped after 100 msec. However, after 200 msec of tripping, current in B_ph appeared again at patna and LBB operated. PG may explain.		Yes	Yes	Breaker conducted attended and rectified.SF6 dew ponit to checked at regular intervals.
10	765 KV MEDINIPUR-NEW JEERAT-2	10-10-2022	22:51	10-10-2022	23:32	Medinipur: DT received	New Jeerat: Didn't trip	No fault	NA	PG may explain		No	No	PLCCSpurious command .
11	400 KV JEERAT-BAKRESWAR-1	11-10-2022	11:24	11-10-2022	11:38	Jeerat: B_N, 144.2 km, 3.4 kA	Bakreswar: B_N, 33.6 km, 4.2 kA	B-Earth	100	Single phase tripping at Jeerat. A/r triggerred but breaker didn't close. Later all three phase tripped on PD after 1.5 seconds. A/r successful from Bakreshwar		Yes	No	A/R relay problematic ,rectified.

12	400 KV MERAMUNDALI-JSPL-1	11-10-2022	11:42	11-10-2022	14:49	Meramundali: B_N, 28.1 km, 9.24 kA	JSPL: B_N, 11 km, 6 kA	B-Earth	100	A/r dead time at Meramundali is set at 300 msec. A/r failed due to persisting fault		Yes	No	Wiil be rectified on 06 december with new A/R relay at JSPL end.
13	400 KV JEERAT-BAKRESWAR-1	11-10-2022	13:08	11-10-2022	13:37	Jeerat: B_N, 158 km, 4 kA	Bakreswar: B_N, 34 km, 5 kA	B-Earth	100	Single phase tripping at Jeerat. A/r triggerred but breaker didn't close. Later all three phase tripped on PD after 1.5 seconds. A/r successful from Bakreshwar		Yes	No	A/R relay problematic ,rectified.
14	400 KV JHARSUGUDA-RAIGARH-2	11-10-2022	16:16	11-10-2022	17:22	Jharsuguda: R_N, 44 km, 7.9 kA		R-Earth	100	A/r failed after 1 sec		Yes	NA	Tripped due to persistent fault
15	400 KV KISHANGANJ-RANGPO-1	12-10-2022	12:24	12-10-2022	13:19	Kishanganj: B_N, 90 km, 4.5 kA	Rangpo: B_N, 96.42 km, 3.628 kA	B-Earth	100	B-Phase voltage touched around 500 kV after 650 msec and other two phase tripped at Kishanganj and DT sent to remote end. High recovery voltage due to resonance. Line reactor tripping scheme may be implemented		Yes	No	Under observation if reapped L/R tripping scheme will be implemeted.

16	400 KV MEDINIPUR-NEW CHANDITALA-1	13-10-2022	11:52	13-10-2022	13:07	Medinipur: Y_N, 70.97 km, 3.86 kA	New Chanditala: Y_N, 10.2 kA	Y-Earth	100	No A/r attempt from chanditala end. A/r lockout appeared after 1 second and DT sent to Medinipur		No	Yes	Rectified.
17	220 KV PATNA-KHAGAUL-1	13-10-2022	15:07	13-10-2022	17:09	Patna: B_N, 8.5 km, 11.89 kA		B-Earth	100	3 phase triiping at the instant of fault no auto reclose .		Yes	No	PLCC unhealthy.
18	765 KV JHARSUGUDA-RAIPUR-1	16-10-2022	20:16	17-10-2022	21:38	B_ph LA burst at Jharsuguda during charging attempt of Raipur-1		B-Earth	100	3 phase triiping at the instant of fault no auto reclose .		Yes	NA	During Charging attempt B-Ph failure and line got tripped
19	400 KV ROURKELA-CHAIBASA-2	18-10-2022	14:18	18-10-2022	14:50	Rourkela: B_N, Zone-2, 134 km		B-Earth	100	3 phase tripping from Rourkela while A/R successful from chaibasa		Yes	Yes	Relay setiing problem which has been corrected.
20	400 KV JAMSHEDPUR-CHAIBASA-2	18-10-2022	14:27	19-10-2022	00:09	Jamshedpur: Y_N, 8.59 kA	Chaibasa: Y_N, 3 km, 14.9 kA	Y-Earth	100	A/r failed after 1 sec		Yes	Yes	A/R not Attempted due to issue in scheme. Same was rectified.

21	400 KV NEW PURNEA-BIHARSHARIF-1	21-10-2022	08:48	21-10-2022	10:14	New Purnea: B_N, 81.49 km, 4.4 kA	Biharsharif: B_N, A/r successful	B-Earth	100	At Biharshariff end it seems A/R of TCB operated while MCB did not reclosed .Needs to be checked		Yes	Yes	MCB A/r willm be checked.
22	400 KV DSTPS-JAMSHEDPUR-1	23-10-2022	09:14	23-10-2022	11:10		Jamshedpur: B_N, 154 km, 1.99 kA	B-Earth	100	A/r successful only from jamshedpur		Yes	No	Shutdown will be taken to check the problem of TCB A/R
23	400 KV ANGUL-BOLANGIR-1	24-10-2022	14:47	24-10-2022	15:41	Angul: B_N, 28.6 km, 7.78 kA	Bolangir: B_N, 173.6 km, 1.21 kA	B-Earth	100	Tripped in reclaim time		Yes	Yes	Tripped due to persistent fault
24	220 KV DARBHANGA (DMTCL)-LAUKAHI-2	26-10-2022	19:32	26-10-2022	21:03		Laukahi: R_N, 23.78 km, 3.422 kA	R-Earth	100	A/R succesfful from DMTCL, Dead time very low of 400 ms may be reveiwed.		Yes	No	Problem not yet identified.
25	220 KV DARBHANGA (DMTCL)-MOTIPUR-1	27-10-2022	17:14	27-10-2022	19:37	DMTCL: R_N, 5.3 km, 12.59 kA	Motipur: R_N, 102.1 km, 1.39 kA	R-Earth	100	A/R successful from motipur end only		Yes	Yes	Carrier signal not healthy.

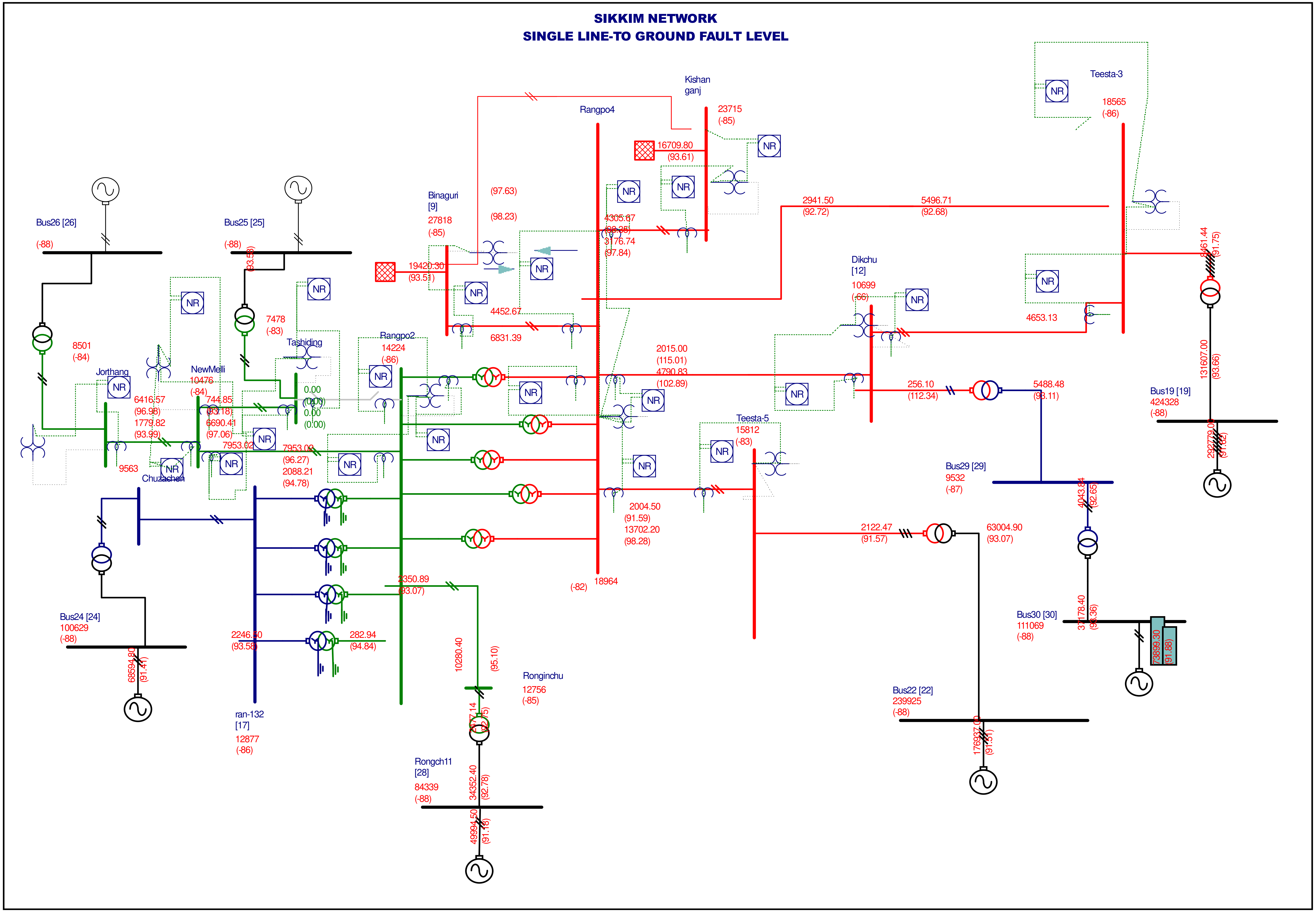
ANNEXURE-C.1

Sl No.	Name of the incidence	PCC Recommendation	Latest status
119th PCC Meeting			
1.	Total Power failure at 220 kV CTPS A and CTPS B (DVC) S/s on 24.09.2022 at 10:55 Hrs	PCC observed that the settings adopted by DVC for broken conductor protection is quite conservative and not the usual practice as followed by other utilities. PCC advised DVC to submit the criteria/philosophy behind such setting and further advised to review the setting and the broken conductor protection may be set in alarm mode instead of issuing tripping command. PCC advised DVC to submit all the relevant DR/EL related to the disturbance at the earliest.	*DVC representative informed that as per advice of PCC, the philosophy of broken conductor protection setting has been reviewed and the setting is being reconfigured to alarm mode instead of trip mode. The work would be completed for all the substations within a month.* *Regarding DR/EL, he informed that relavant DR/EL had already shared with ERPC/ERLDC. Regarding autorecloser discrepancy in Kalyanswer circuit-2, he informed that the relay was tested and found healthy. However the issue has been referred to the OEM for further analysis.*
2.	Disturbance at 220 kV Tenughat (TVNL) S/S on 09.09.2022 at 12:55 Hrs	PCC advised JUSNL to rectify all clearance related issues present in 220 kV Tenughat-Govindpur D/C line so that similar type of incidents can be avoided in future. PCC advised JUSNL to share PSL logic of relay to ERPC/ERLDC. It further advised JUSNL to communicate this matter to relay manufacturer for testing and updating firmware in the relay. PCC advised TVNL to review overcurrent settings of unit #2 considering the present transmission network & fault level data at Tenughat. The coordination study may be done considering when one unit in operation & there is a line fault in one of the outgoing	*JUSNL representative informed that testing of relay at Dumka end for 220 kV Dumka-Govindpur line will be completed within a week.* *Regarding updating firmware in relay, JUSNL representative informed that site visit of relay engineer has been scheduled in last week of Nov-22.* *TVNL representative informed that they are in*

		feeders (worst case scenario). The revised setting may be implemented at Unit end & the same may be intimated to PCC.	*communication with PRDC in order to review* overcurrent *settings of unit #2. He further added that as per M/s BHEL has also been communicated with regard to the review of the settings in Unit #2.*
3.	Repeated Disturbances at 220 kV Ratu(JUSNL) S/s	PCC opined that all utilities may share the best practices adopted in their system to avoid such type of maloperation of Transformers/Reactors so that a common best practice may be compiled and shared for benefit of all.	*All utilities were once again requested to share the best practices adopted in their system to avoid maloperation of Transformers/Reactors so that a common best practice may be compiled and shared for benefit of all.*
4.	Tripping of 220 kV Bus-1 at Ramchandrapur on 28/09/2022 at 15:49 Hrs	PCC suggested that CT connection may be checked for C-phase for all the feeders connected to busbar relay and the reporting of C-phase current of each 220 kV feeder to busbar relay may be checked.	*JUSNL representtaive informed that CT wiring and polarity had been checked but no abnormailty was found. He added that OEM had been communicated on this issue.*
118th PCC Meeting			
5.	Disturbance at 400 kV Dikchu S/s on 10.08.2022 at 11:57 Hrs	PCC advised Dikchu HEP to expedite the visit of relay engineer and resolve the issue by Sep-22. PCC also raised serious concern about long outage of the main bus-2 of Dikchu HEP and advised DIkchu HEP to continuously take up with the vendor for supply of the breaker at the earliest. Further, Dikchu HEP was advised to submit a firm time-line for restoration of the main bus-2 which would be monitored in PCC meeting.	*Regarding breaker, Dikchu HEP representative informed that breaker will reach the site by end of Nov 2022.* *Regarding autorecloser issue, He informed that service engineer is presently at site and testing of logic had been completed however no abnoramilty was found. Testing of wiring in relay is in progress and final report*

			will be shared with ERPC/ERLDC.
117th PCC Meeting			
6.	Total Power failure at 220 kV Joda (OPTCL) S/s on 27.07.2022 at 11:30 Hrs	OPTCL representative replied that they would take necessary action for implementing autorecloser without PLCC at TTPS end. Further he informed that OPGW for the above line has been commissioned and after completion of DTPC commissioning work, the A/R scheme with OPGW communication would be implemented subsequently.	No update in 119th PCC Meeting. *OPTCL representative informed that work will start after handover of the TTPS switchyard from NTPC.*
7.	Tripping of 220 kV TLDP IV-NJP line.	PCC opined that carrier healthiness may be checked between NJP & TLDP by performing end to end testing in the line and therefore advised NHPC & WBSETCL to coordinate with each other to complete the test. Meeting was held among testing wing, communication wing and O&M of WBSETCL at NJP substation. The minutes of meeting is attached at **Annexure C.1.7.**	*WBSETCL representative informed that faulty PLCC is BPL make and communication had already been made to their telecom wing for replacement of same. However as replacement would take some time,he suggested that DT can be disabled on both end so that spurious tripping can be avoided. TLDP representative also agreed with the proposal of WBSETCL. PCC advised to disble the DT in the relay for 220 kV TLDP-NJP line till the PLCC issue gets rectified.*

Annexure C.2



SIKKIM NETWORK
SINGLE LINE-TO GROUND FAULT LEVEL
Teesta-3
18565
(-86)
Kishan ganj
23715
(-85)
Rangpo4
16709.80
(93.61)
Binaguri
[9]
27818
(-85)
(97.63)
(98.23)
19420.30
(93.51)
4305.67
3176.74
(97.84)
4452.67
6831.39
2941.50
(92.72)
5496.71
(92.68)
Dikchu
[12]
10699
4653.13
Bus26 [26]
(-88)
Bus25 [25]
(-88)
8501
(-84)
7478
(-83)
Tashiding
Rangpo2
14224
(-86)
Jorthang
NewMelli
10476
(-84)
6416.57
(96.98)
1779.82
(93.99)
744.85
6690.41
(97.06)
7953.02
(96.27)
2088.21
(94.78)
9563
Chuzachen
0.00
2015.00
(115.01)
4790.83
(102.89)
256.10
(112.34)
5488.48
Teesta-5
15812
(-83)
Bus19 [19]
424328
(-88)
131607.00
(93.66)
Bus29 [29]
9532
(-87)
2004.50
(91.59)
13702.20
(98.28)
2122.47
(91.57)
63004.90
(93.07)
(-82)
18964
2350.89
(93.07)
Bus24 [24]
100629
(-88)
2246.50
282.94
(94.84)
10280.40
(95.10)
Ronginchu
12756
(-85)
ran-132
[17]
12877
(-86)
Rongch11
[28]
84339
(-88)
34352.40
(92.78)
Bus30 [30]
111069
(-88)
Bus22 [22]
239925
(-88)
NR

Line	Relay Connected at	CT Ratio in A	Fault Location	Fault Current seen by the Relay	Existing			Proposed			
					Ie> in A (Primary)	TMS	Top in sec	Ie> in A (Primary)	TMS	Top in sec	TMS (correct)
Binaguri-Rangpo	Rangpo end	2000/1	Binaguri	4453	200	0.568	1.241985	400	0.564	1.6	0.56
Binaguri-Rangpo	Binaguri end	2000/1	Rangpo	6831	200	0.638	1.220696	400	0.667	1.6	0.67
Kishangunj-Rangpo	Rangpo end	3000/1	Kishangunj	3177	1200	0.514	3.65964	600	0.387	1.6	0.39
Kishangunj-Rangpo	Kishangunj end	3000/1	Rangpo	4306	400	0.28	0.805367	600	0.459	1.6	0.46
Rangpo- Dikchu	Rangpo end	3000/1	Dikchu	4791	200	0.61	1.302136	600	0.333	1.1	0.33
Rangpo- Dikchu	Dikchu end	3000/1	Rangpo	2015	600	1.5 (DT)	1.5	600	0.21	1.2	0.21
Rangpo- TeesthaV	Rangpo end	2000/1	Teestha V	13702	200	0.6	0.952209	400	0.575	1.1	0.58
Rangpo- TeesthaV	TeesthaV end	2000/1	Rangpo	2005	-	-		400	0.281	1.2	0.28
Rangpo-Teestha III	Rangpo end	3000/1	Teestha III	5497	1200	0.28	1.268379	600	0.356	1.1	0.4
Rangpo-Teestha III	Teestha III end	2000/1	Rangpo	2942	-	-		400	0.349	1.2	0.35
Dikchu-Teestha III	Dickchu end	3000/1	Teestha III	4653	400	1.5 (DT)	1.5	600	0.358	1.2	0.36
Dikchu-Teestha III	Teestha III end	3000/1	Dikchu	5832	-	-		600	0.399	1.2	0.40
Rangpo 220Kv Bus											
Rangpo- Newmelli	Rangpo end	1600/1	Newmelli	7953	320	0.399	0.841655	320	0.427	0.9	0.43
Rangpo- Newmelli	Newmelli end	1600/1	Rangpo	2088	320	0.33	1.208623	320	0.246	0.9	0.25

Tasheding-Newmelli	Tasheding end	800/1	Newmelli	745	160	0.24	1.075464	160	0.223	1	0.22
Tasheding-Newmelli	Newmelli end	1600/1	Tasheding	6690	320	0.314	0.701258	320	0.403	0.9	0.40
Newmelli-Jorethang	Newmelli end	400/1	Jorethang	6417	-	0.473		80	0.589	0.9	0.59
Newmelli-Jorethang	Jorethang end	400/1	Newmelli	1780	300	0.09	0.347553	300	0.155	0.6	0.16
Rangpo - Ronginchu	Rangpo end	1600/1	Ronginchu	10280	208	0.52	0.897307	208	0.522	0.9	0.52
Rangpo - Ronginchu	Ronginchu end	400/1	Rangpo	2351	60	0.5 (DT)	0.5	80	0.500	1	0.50

This is the condition by taking peak generation at all individual substation

Annexure C.3

220kV Bus Bar Protection status at BSPTCL

Sl. no.	Name of the GSS	Status	Remarks
01	Fatuha	GE make Bus Bar Panel available at site. Its commissioning work is pending as one of the relay found defective during panels testing. Relay replacement and further commissioning work to be done by agency.	Continuous follow up from site is needed.
02	Khagaul	Bus Bar Protection Panel not available. One main one transfer bus scheme.	New installation and commissioning is needed.
03	Biharsharif	• Installation and commissioning of new Bus Bar Protection Panel was awarded to M/s GE in 2015, but work remained partially completed and executing agency left midway. • At present 18 no of 220kV bays are available which cannot be integrated in existing Bus Bar Protection Relays. • Also, suitable space is not available in cable trench.	• As per service engineer of m/s GE following modification in old Bus Bar scheme is needed. a) Scheme modification b) Hardware modification c) Software modification d) Firmware modification. • Suitable space in cable trench also needed.
04	Dehri	Bus Bar Panel not available. One main one transfer bus scheme.	New installation and commissioning is needed.
05	Bodhgaya	Bus Bar Panel not available. One main one transfer bus scheme.	New installation and commissioning is needed.
06	Sampatchak	• ABB make Electromechanical type Bus Bar Panel available but not in service due to cases of mal operation. • An estimate for new bus bar scheme prepared and submitted, as per field officials. • Fault Data extraction facility not available in present scheme.	Retrofitting with Numerical type Bus Bar Relay or change of complete Bus Bar Panel is needed for Proper Data Extraction and Fault Analysis
07	Begusarai	ABB make Electromechanical type Bus Bar Panel available but not in service. Fault	Retrofitting with Numerical type Bus Bar Relay or

		Data extraction facility not available in present scheme.	change of complete Bus Bar Panel is needed for Proper Data Extraction and Fault Analysis
08	Bihta new	Alstom make Bus Bar Protection scheme available. Not in service since 28.08.21 due to repeated operation of Y phase Bus Bar Relay. Matter communicated to OEM for rectification of Y phase relay.	Defective relay needs to be replaced to take the Bus Bar Protection system in service
09	Pusauli	ERL make numerical type Bus Bar Protection panel available, but out of service due to mal operation just after commissioning of the GSS.	As it is not working properly since its commissioning in 2015, thorough inspection from OEM is needed.
10	Gopalganj	• As reported, Bus Bar Protection panel was not working properly after its commissioning in 2005. • Easun make **Digital type** Bus Bar Panel available but out of service. Fault Data extraction facility not available.	Retrofitting with Numerical type Bus Bar Relay or change of complete Bus Bar Panel is needed for Proper Data Extraction and Fault Analysis
11	Hajipur	• ABB make **Electromechanical type** Bus Bar panel available but out of service since 03 nos. GSS Bays of BGCL commissioned in same switchyard in 2016. • Fault Data extraction facility not available in present scheme.	Retrofitting with Numerical type Bus Bar Relay or change of complete Bus Bar Panel is needed for Proper Data Extraction and Fault Analysis
12	Darbhanga	• As reported, Bus Bar Protection Panel was not working properly after its commissioning in 2006. • Easun make **Digital type** Bus Bar Panel available but out of service. Fault Data extraction facility not available.	Retrofitting with Numerical type Bus Bar Relay or change of complete Bus Bar Panel is needed for Proper Data Extraction and Fault Analysis
13	Sonenagar NEW	Working	Bus Bar Protection testing done in July 2021 for integration of 220/132 kV 160 MVA ICT.
14	Motipur	Working	
15	Musahari	Working	

16	Khagaria new	Working	Bus Bar Protection testing done on 18/01/22 for integration of 220kV Saharsa New (PGCIL) d/c bays
17	Kisanganj new	Working	Bus Bar Protection testing done on 05/03/22 for integration of 220kV Thakurganj (u/c) d/c bays
18	Madhepura	Not Working	• Existing Bus Bar scheme has 04 nos. of bays. • 06 nos. of bays not integrated. • Electromechanical type Bus Bar scheme, fault Data extraction facility not available.
19	Laukahi	Working	

Present Status of Busbar Protection for 220 KV System (JUSNL)

Name of Substation	Relay Make	Relay Model	Numerical/Static	Busbar Status	Remarks
220/132KV Hatia-II GSS	Siemens	SIPROTEC 7SS525	Numerical	Working	
220/132/33 KV Burmu (Ratu) GSS	ABB	REB670	Numerical	Working	
220/132KV Dumka-II (Madanpur) GSS	Schendier (MiCOM)	MiCOM P743(Bay Unit) MiCOMP741(Central Unit)	Numerical	Working	
220/132/33 KV Godda GSS	ZIV	Central Unit-DBC Bay Unit-DBP	Numerical	Working	
220/132/33 KV Jasidih GSS	ZIV	Central Unit-DBC Bay Unit-DBP	Numerical	Working	
220/132/33 KV Giridih GSS	Siemens	SIPROTEC 7SS85	Numerical	Working	
220/132/33 KV Lalmatia GSS	N/A				Single main bus With transfer bus
220/132 KV Chandil GSS	N/A				Single main bus With transfer bus
220/132KV Ramchanderpur GSS	GE	Multilin B90	Numerical	Working	Spurious operation of busbar protection was observed in recent past. The scheme requires detail checking.
220/132KV Chaibasa-II GSS (Ulijhari)	Schendier (MiCOM)	MiCOM P743(Bay Unit) MiCOM P741(Central Unit)	Numerical	Working	During 3rd party protection audit, busbar protection is found to be not in operation due to issue in peripheral unit.
220/132KV Bhagodih (Garhwa New) GSS	ZIV	Central Unit-DBC Bay Unit-DBP	Numerical	Working	
220/132/33 KV PTPS Switchyard	N/A				All the 220KV Bays will be shifted to 400/220KV PTPS_New GSS
220/132/33 KV Govidpur GSS	ZIV	Central Unit-DBC Bay Unit-DBP	Numerical	Working	
220/132/33 KV Itakhori GSS	ZIV	Central Unit-DBC Bay Unit-DBP	Numerical	Working	

Present status of bus bar protection for 220 kV system at OPTCL

220/132/33 KV Bargarh New	GE	B90 Multiline	Numerical	Healthy	
220/132/33 KV Nayagarh					New Numerical Relay will be commissioned during ongoing SAS Project.
220/132/33 KV Samangara	SIEMENS	SIPROTEC 7SS52	Numerical	Unhealthy	01no. Bay Unit (Bus Coupler) is defective. 220kV power supply is not available due to breakdown of D/C Lines during cyclone.
220/132/33 KV Chandaka	SIEMENS	SIPROTEC 7SS52	Numerical	Healthy	
220/132/33 KV Cuttack	SIEMENS	SIPROTEC 7SS5251	Numerical	Healthy	
220/132/33 KV Bidanasi	SIEMENS	SIPROTEC 7SS52	Numerical	Healthy	
220/132/33 KV Paradeep	ALSTOM	BCU-P40 AGILE,P743; MCU-P40 AGILE,P741	Numerical	Not Commissioned	Will be commissioned during ongoing SAS Project.
220/33 KV Rengali	ER	B3, B24H2	Electromagnetic	Defunct	To be replaced by Numerical Relay
400/220/132/33 KV Meramundali	SIEMENS	SIPROTEC 7SS52	Numerical	Unhealthy	Central Unit & 01no. Bay Unit are defective.M/s SIEMENS has been contacted for rectification.
220/132/33 KV Bhadrak	AREVA	P141	Numerical	Defunct	To be replaced by Numerical Relay.

220/132/33 KV Bolangir New	ABB	REB500	Numerical	Not Commissioned	New Numerical Relay will be commissioned during ongoing SAS Project.
220/132/33 KV Narendrapur	SIEMENS	SIPROTEC 7SS52	Numerical	Healthy	
400/220/132/33 KV Lapanga	SIEMENS	SIPROTEC 7SS52	Numerical	Not Commissioned	Will be Commissioned after procurement of CT Primary links for higher CT Ratio.
220/132/33 KV Katapalli	ABB	REB500	Numerical	Not Commissioned	New Numerical Relay will be commissioned during ongoing SAS Project.
220/132/33 KV Budhipadar	SIEMENS	SIPROTEC 7SS52	Numerical	Healthy	
220/132 KV Tarkera	SIEMENS	SIPROTEC 7SS52	Numerical	Healthy	
220/132/33 KV Jayanagar	SIEMENS	SIPROTEC 7SS52	Numerical	Healthy	
220/132/33 KV Therubali	SIEMENS	SIPROTEC 7SS52	Numerical	Healthy	
220/33 KV Infocity-2	SIEMENS	SIPROTEC 7SS54	Numerical	Healthy	
220/33 KV Narsinghpur	GE	B90 Multiline	Numerical	Healthy	
220/33 KV Ranki/ Keonjhar	TOSHIBA	GRB200	Numerical	Healthy	

220/33 KV Barkote	ALSTOM	FAC34RF111B	Electromechanical	Not Commissioned	To be replaced by Numerical Relay of new version.
220/33 KV Bonai	GE	B30 Multiline	Numerical	Not Commissioned	To be replaced by Numerical Relay of new version.
220/33 KV Malkangiri	SIEMENS	SIPROTEC 7SS52	Numerical	Healthy	
220/33 KV Balimela	ABB	SPAE 010	Static	Defunct	To be replaced by Numerical Relay of new version.
220/33 KV Kashipur	GE	B90 Multiline	Numerical	Unhealthy	Central Unit & 01no. Bay Unit are defective.M/s GE has been contacted for rectification.
220/33 KV Laxmipur	SCHNEIDER	MICOM P741	Numerical	Healthy	

Present Busbar Protection Status of 220 KV System under WBSETCL

Name of Substation	Relay Make	Type	Numerical/Static	Status	Remarks
Alipurduyar 220 KV	Siemens	7SS52	Numerical	Functional	
New Jalpaiguri 220 KV	Abb	RADSS	Static	Functional	
Dalkhola 220 KV	Abb	RADHA	Static	Functional	
Gazole 220 KV	Siemens	7SS85	Numerical	Functional	
Gokarna 400 KV	Abb	REB670	Numerical	Functional	Put into service on 11.11.2022
Rejinagar 220 KV	Alstom	Micom P741/743	Numerical	Functional	
Sagardighi 220 KV	ZIV	DBC/DBP	Numerical	Functional	
Jeerat 400 KV	Abb	REB670	Numerical	Functional	
Dharampur 220 KV	Alstom	Micom P746	Numerical	Functional	
Krishnanagar 220 KV	Areva	FAC34	Static	Functional	
Kasba 220 KV	Abb	REB670	Numerical	Functional	
KLC 220 KV	Abb	REB670	Numerical	Functional	
NewTown 220 KV	Abb	RADHA	Static	Functional	
Barasat 220 KV	Siemens	7SS85	Numerical	Functional	
Subhasgram 220 KV	Areva	FAC34	Static	Functional	
Laxmikantapur 220 KV	Abb	REB670	Numerical	Functional	
New Haldia 220 KV	Abb	RADHA	Static	Functional	
Domjur 220 KV	Abb	RADHA	Static	Functional	
Foundry Park 220 KV	Siemens	7SS52	Numerical	Functional	
Howrah 220 KV	Areva	FAC34	Static	Functional	
Rishra 220 KV	Abb	RADHA	Static	Functional	
Chanditala 400 KV	Alstom	Micom P741/743	Numerical	Functional	
Midnapore 220 KV	Abb	RADHA	Static	Functional	
Kharagpur 400 KV	Alstom	Micom P741/743	Numerical	Functional	
Vidyasagar Park 220 KV	Alstom	MFAC34	Static	Functional	
Egra 220 KV	Siemens	7SS85	Numerical	Functional	
New Bishnupur 220 KV	Abb	REB670	Numerical	Functional	

Arambag 400 KV	Abb	REB670	Numerical	Functional	Put into service on 28.04.2022
Satgachia 220 KV	Abb	REB670	Numerical	Static relay replacing by Numerical	Put into service on 07.11.2022
Durgapur 220 KV	Abb	REB670	Numerical	Functional	
Sadaipur 220 KV	Abb	REB670	Numerical	Functional	
Asansol 220 KV	Abb	RADHA	Static	Functional	
Hura 220 KV	Siemens	7SS52	Numerical	Functional	

Annexure C.5.1

Protection Audit Recommendations for the Stations audited protection audit team of ERPC				
Sl No.	**Name of Substation**	**Owner**	**Date of Audit**	**Remarks/Recommendation**
1	765/400 kV Sundergarh S/s	Powergrid	25.04.2022	1.Switchyard equipments are in good and healthy condition. Switchyard area as well as overall station is well maintained.
				2.Provision for nameplate with bay/line name may be done in front of SPR(Kiosk) in switchyard for easy identification.
2	400/220/132 kV Lapanga(OPTCL) S/s	OPTCL	26.04.2022	1.Event logger is not available for 220 kV System. The same shall be provided.
				2.Time synchronising equipment is not available for 220 kV system.
				3.Busbar/LBB protection is not available for 220 kV system . The same shall be commissioned at the earliest.
				4.Autorecloser is implemented without PLCC for all the 220 kV feeders. It was informed that OPGW for these lines are under commissioning.
				5.OPGW/DTPC commissioning may be expedited and thereafter carrier based autorecloser as well as intertripping scheme may be implemented for 220 kV lines.
				6.For 220 kV control room housing the relay panels, air conditioning shall be provided for proper functioning of protection system panels & to prevent failure of numerical protection systems.
				7.Zone settings(zone-2, zone-3 & zone-4) in distance protection relay may be reviewed for all the 400 & 220 kV lines in line with the ERPC Protection philosophy.
				8.Group protection for 400 kV Lapanga-Meramundali line may be enabled and two group settings may be kept in the relay. One group considering 400 kV M'mundali-Bolangir in service and another group setting when 400 kV M'mundali-Bolangir is not in service. Group to be selected as per the actual configuration.
				9.Autorecloser in 400 kV Lapanga-Meramundali line is having some issue. The same may be rectified.
				10.Power swing blocking enabled for all zones. It may reviewed and blocking may be done all the zones except zone-1.
				11.Grading in terms of time/voltage setting shall be done in Overvoltage settings of 400 kV lines.
3	220/132 kV Budhipadar(OPTCL) S/s	OPTCL	26.04.2022	1. Time synchronising equipment in substation control room is not working. The same may be rectified & put into service.
				2.Main-I relay of 220 kV Budhipadar-Lapanga-I feeder and main-2 relay of 220 kV Budhipadar-SMC feeder was found to be defective and not in operation. Defective relay shall be changed with spare/new relay immediately.

				3.Main-1 relay of following fedders are of static type. 220 kV Budhipadar-IB TPS line, 220 kV Budhipadar-Tarkera D/c line, 220 kV Budhipadar-Raigarh PG. All Electro Static Relays may be replaced with latest version of Numerical relays for quick and accurate analysis of Trippings.
				4.DC earth leakage were found in both DC-I & II sources. The same may be attended. Continous monitoring of dc earth leakage measurements to be done.
				5.PLCC is not in service for most of the lines. Autorecloser w/o PLCC is implemented for some of the feeders like 220 kV Tarkara D/C, 220 kV Lapanga D/C feeder. For rest of the feeders auto recloser was not in service.
				It was informed that OPGW for these lines are under commissioning. OPGW/DTPC commissioning may be expedited and thereafter carrier based autorecloser as well as intertripping scheme shall be implemented for 220 kV lines.
				6.For 220 kV Budhipadar-Korba-1 &2, the PLCC is not working and found to be out of service since long. Being inter-regional line, matter may be taken up with appropriate authority for restoring the PLCC communication in the line. Alternatively, It is suggested that carrier communication through OPGW network may be planned & implemented.
				7.Zone settings for all 220 kV lines need to be reviewed in line ith ERPC Protection Philosophy & considering the present network configuration at the remote end substations.
				8.Busbar protection is available for a single bus only. For other bus, it is out of service due to defective bay units. It is advised to restore the busbar protection for the second bus at the earliest. Similarily zone-4 settings of feeders corresponding to the bus for which busbar is out of service may be reduced to 250 msec.
				9. Oil leakages was observed in 220/132 kV Auto-I. Action may be taken to address the same.
				10.Vegetation shall be cleared & proper PCC and gravelling should be done in the switchyard.
				General:
				1. Uniform protection philosophy may be adopted across OPTCL network
				2. Protection co-ordination to be done as and when there is change in network configuration or commissioning of new lines
				3. O/V voltage/time gradation to be done for S/s level
				4. Periodic internal review of implemented protection settings
4	220 kV IB TPS	OPGC	27.04.2022	1. Event logger is not available for 220 kV system. The same shall be provided.
				2. Zone-2 tmer setting may be reviewed considering the shortest line at remote end(budhipadar) for all 220 kV lines

				3. Zone-4 reach and time delay may be reviewed for all 220 kV lines
				4. Zone-3 time delay may be reviewed as it is encroaching next voltage level (220 kV Lines)
				5. PLCC not operational for all four 220 kV feeders. It was informed that OPGW/DTPC based communication system will be commissioned in near future.
				6. OPGW/DTPC commissioning may be expedited and thereafter carrier based autorecloser as well as intertripping scheme may be implemented for 220 kV lines.
				7. Busbar relay is of static type. It was informed that renovation & upgradation of 220 kV switchyard is under proposal stage.
5	400 kV OPGC S/s	OPGC	27.04.2022	1. At 400 kV level, it was found the both main-1 & main-2 relays of outgoing transmission lines are of same make & model employing different characteristic. It is recommended that different make & model for main-1 &2 relay is preferable and same may be implemented.
				2. Overvoltage setting for the lines need to be reviewed. Time grading / voltage grading may be done in the overvoltage settings for different lines/for overall substation
				3. DR time window may be increased. DR configuration may be done in line with guidelines approved in ERPC PCC meeting.
				4. Overcurrent protection in 400 kV lines may be disabled.
				5. Provision for sending DT signal to other end during operation of DEF protection may be implemented.
				6. Line length for 400 kV OPGC-Lapanga line may be verfied in consultation with OPTCL.
				7. Zone-2 & Zone-3 settings of all 400 kV lines need to be reviewed and set as per the ERPC Protection philosophy.
				8. Adjacent shortest and longest line length maybe verified and zone settings maybe implemented accordingly
				9. Power swing block enabled for all zones. May be reviewed
6	765 kV Darlipali(NTPC) S/s	NTPC	28.04.2022	1. Time grading to be done in stage-I overvoltage settings for 765 kV Darlipalli-Jharsuguda D/c line.
				2. Power Swing blocking enabled for all zones. May be reviewed.
				3. Relay setting data is not available in Protection database of ERPC. The same may be updated at the earliest.

Annexure C.5.2

Annexure-A				
Protection Audit Recommendations for the Stations audited by protection audit team of ERPC				
Sl No.	**Name of Substation**	**Owner**	**Date of Audit**	**Remarks/Recommendation**
1	400/220 kV Jamshedpur S/s	Powergrid	20.07.2022	1.Time synchronization for some of the relays are not as per the GPS clock. The same may be rectified. 2.Zone-2 timer setting for all 400 kV lines is set to 500 msec. The same may be reviewed in line with ERPC Protection guidelines. 3. TMS value of backup overcurrent IDMT relay is different for three ICTs whereas the pickup value is same for all the ICTs. Similarly TMS of backup earthfault relay for ICT-1 & ICT-2 is different than ICT-3. It is recommended to set TMS value for overcurrent relay as well as backup E/F relays uniform among all three ICTs.
2	400/220 kV Chaibasa S/s	Powergrid	21.07.2022	1.Switchyard equipments are in good and healthy condition. Switchyard area as well as overall station is well maintained. 2.Though Overvoltage stage 1 settings are graded in time or voltage magnitude between the two ckts of Rourkella or Chaibasa or jamshedpur ,they are not so clearly graded as whole(Rourkella 1 and Jamshedpur 1 having identical settings).This part may be reviewed and the shorter line may be made to have higher magnitude or time value relative to the longer lines. No two 400 KV line should have exactly same settings in voltage triggering value or time delay.

3	220/132 kV Chandil(JUSNL) S/s	JUSNL	20.07.2022	**General:**
				1. Uniform protection philosophy shall be adopted across JUSNL network in line with ERPC Protection philosophy.
				2. Protection co-ordination to be done as and when there is change in network configuration or commissioning of new lines.
				3. Review of implemented protection settings need to be carried out periodically for JUSNL system..
				4.Measures shall be taken to ensure healthiness of busbar/LBB protection relay & PLCC system in the substation.
				1. Time synchronising equipment in substation is not available.
				2.For 220 kV Ranchi Feeder, only main-I protection relay is present along with separate back-up overcurrent relay. Main-2 protection relay shall be installed for this line.
				3. Peak load served by the station is 240 MVA,however three out of four 100 MVA 220/132 KV ATR are functional. 4th ATR is out since 30.4.2020 and replacement status is not available.N-1 relibility criteria is being not satisfied during peak condition. Steps may be taken at the earliest to bring 4th ATR into service.
				4.Oil leakage found in ATR-1. However due to high demand, the shutdown is not being allowed and the issue can not be attended. The same may be looked into urgently.
				5.220 kV is having sing main & transfer bus scheme. As intimated by S/s incharge, proposal for bus sectionalizer in 220 kV bus is under consideration.
				6.Busbar/LBB protection is not available.
				7.Zone 4 delay time for all 220 kV lines is 300 ms.it may be made 250 ms as Bus bar protection is not commissioned.
				8.Disturbance recorders shall be configured as per the DR standard guidelines of ERPC.
				9. For Santaldih ckt, zone 2 reach has been setting has been done as 18.97 Ω which seems to be on the higher as it is appearing to be 120% of line length + 50% of Shortest adjacent line. As per ERPC guideline, the same for 220 KV line should be either 120% of line length or (100% of length+ 50% of shortest adjacent line).
				10.For Ramchandrapur line, zone 3 value is 23.87 Ω. However, this value is encroaching the 2x150 MVA 220/132 KV ATR impedance in Ramchandrapur as seen from chandil,so the time delay of zone 3 may be suitably reviewed and coordinated with fault clearing time of the said ATR.
				11.Only one DC battery source is found in service while other is in spare and not in service simultaneously. For 220 KV, Two separate Dc sources are recommended feeding to main 1 and main 2 relays with separate trip coils as per CEA construction standards.
				12.Power swing block is enabled for all the zones in 220 kV lines. It is recommended to block zone 2 and above with unblocking time of 2 seconds
				13.REF protection for ATRs is not available in all but one. For one ATR, though REF protection is avaialble, REF has been kept disabled after it maloperated during through faults. It is advised to implement REF protection for all the transformers.
				14.DC earth leakage was found. Battery connectors were found to have oxidized etching marks. Action may be taken to rectify the above issue.
				15.PLCC channels are not healthy for Ranchi line.For Sanataldih circuit, the autorecloser dead time setting may be checked and set to 1 sec.
				16.Bus CVT is being used for distance protection relay of 220 kV feeders. Provision for line CVT in 220 kV Feeders may be envisaged and implemented.
				17.PCC & Gravelling may be done for complete area of 220 kV Switchyard.
				18.LA counter is missing in ATR-2. The same may be provided.
				19.Zone settings for all 220 kV lines need to be reviewed in line ith ERPC Protection Philosophy & considering the present network configuration at the remote end substations.

4	220 kV Ramchandrapur	JUSNL	21.07.2022	1. Bus 2 PT is not in service. Only bus 1 PT is present and it is being used in distance relay for covering short line section between the 220 KV side 400/220 KV Jamshedpur ICT terminals to 220 KV Ramchandrapur bus .Bus-2 PT may be replaced at the earliest.
				2.Requirement of distance protection on RCP end for the line section of 220 kV RCP-Jamshedpur(PG) may be reviewed. In case distance protection remain in operation, provision for line CVT may be envisaged where distance protection is in service.
				3.Only one DC battery source is found in service while other is in spare and not in service simultaneously. For 220 KV level, Two separate Dc sources are recommended feeding to main 1 and main 2 relays with separate trip coils as per CEA construction standards. Necessary action may be taken to operate two sources in parallel.
				4.DR is not GPS time synchronised. The same may be rectified.
				5. DR time window may be increased. DR configuration may be done in line with guidelines approved in ERPC PCC meeting.
				6.Busbar relay panel is placed in old control room without Air Conditioning.Action may be taken to place the busbar panel in a AC room.
				7.Zone settings for chandil line shall be reviewed in line with ERPC protection philosophy.
				8. Zone-2 & zone-3 reach setting may be reviewed for Chaibasa fedder
				9.Zone-3 setting may be reviewed for 220 kV RCP-Joda feeder.
				10. LBB relays are not for individual bay as a result LBB protection is not functional although busbar protection is in service. As per CEA grid connectivity regulation, LBB is mandatory for 220 kV S/s. Action may be taken to implement the same.
				11.Power swing block is enabled for all the zones in 220 kV lines. It is recommended to block zone 2 and above with unblocking time of 2 seconds
				12.Autoreclose scheme is implemented without PLCC . Dead time is seen to be 1.2 sec ,while recommendation is 1 sec. Reclaim time is 3 seconds while recommendation is 25 seconds.Above settings may be reviewed.
				13.PLCC is healthy only for 220 kV Chaibasa lines. For rest 220 kV feeders, steps may be taken to address the PLCC issue and put into service at the earliest.
				14.N-1 relaibility criteria is not being satisfied for 200/132 kV ATRs in both peak & off-peak period.Out of 3 ATRs available, one is out of service due to bushing failure since long wheras another transformer is being operated in very critical condition having heavy oil leakge. As per the reports submitted in S/s, the parametes w.r.t. transformer oil and bushing is not as per the standard. It is recommended that complete overhauling/replacement of ATR-2 may be done at the earliest. SImilarly action may be taken for bushing replacement for ATR-1 which is out of service since long.
				15.PCC & Gravelling may be done for transformer bays in 220 kV Switchyard.
				16.REF protection is not in service for both the 220/132kV transformers. The same may be implemented.

5	220 kV Chaibasa S/s	JUSNL	21.07.2022	1. Disturbance recorders are not time synchronised.
				2. DR time window may be increased. DR configuration may be done in line with guidelines approved in ERPC PCC meeting.
				3. Zone-2 reach setting & zone-3 timer setting for Ramchandrapur feeder shall be reviewed in line with ERPC protection philosophy.
				4. Overvoltage protection was seen to be enabled with stage 1 at 110%,5 sec delay. The same may be disabled or set to a higher value(greater than 112 %).
				5.For Ramchandrapur feeders, autorecloser is not in service for both the circuits due to issue in BCU panel. The issue may be looked into at the earliest.
				6. Zone-3 & Zone-4 reach setting to be reviewed for 220 kV Chaibasa-Chaibasa(PG) line.
				7. In 150 MVA 220/132 KV ATR, low set current pickup setting in backup O/C relay is 1048 A ,which is 260% of transformer rated current. This current pick up setting may be reviewed.
				8.The bus bar protection relay is not functional due to fibre communication error as shown in relay display. Being a imporatant protection in the substation, immediate measure shall be taken to rectify the issue and bring the busbar relay into service.
				9. Air conditioning is not working in the kiosks housing the relay panel for different bays. AC shall be provided for proper functioning of protection system panels & to prevent failure of numerical protection systems.
				10.It is seen in the switchyard that both bus side isolators of 220 KV Chaibasa Chaibasa ckt 2 and 220 KV Chaibasa Ramchandrapur ckt 1 are in closed condition. This may be immediately changed to a single bus only as whenever there is a bus fault in either of 220 KV bus,both lines will trip during fault clearance. Necessary modification may be made in wiring of bus bar relay and Peripheral units.
				11.DC earth leakage was observed in one of the DC sources. The same may be attended.
6	220 kV Jamshedpur S/s	DVC	22.07.2022	1.PLCC is not working for 220 kV JSD-Jindal line. Therefore autorecloser scheme is kept disabled for the line. PLCC panel is present at Jamshedpur end however there is no information of PLCC at JSPL end. The matter may be taken up with appropriate authority for commissioning PLCC in the line.
				2. Disturbance recorder configuration to be done as per DR standard guidelines by ERPC. CB close status(CB open shall be configured in DR instead of CB Close) to be rectified and DR window size to be increased in DR.
				3. Time synchronising equipment in substation control room is not working. The same may be rectified & put into service.
				4.DC earth leakage were found in both DC-I & II sources. The same may be attended. Continous monitoring of dc earth leakage measurements to be done.
				5.For JSPL circuit, Zone 2 reach is encroaching half of next shortest adjacent line,so time delay is seen to be 500 ms. Alternatively,reach may be reduced from 120% of length to line length plus 50% of SAL ,while time delay can be maintained at 350 msec. To be reviewed.
				6. Zone-2 reach setting for Bokaro line may be reviewed considering the shortest adjacent line as 220 kV BTPS-CTPS.
				7.As informed by S/s Incharge, in the LBB protection there is no provision of sending DT signal to other end of the line. The scheme may be reviewed and transmitting DT signal to other end in LBB protection may be incorporated.

Power Research & Development Consultants Pvt Ltd.

Welcome to ERPC Officials

Annexure C.6

Creation and maintaining a Web based Protection Database and Desktop based Protection setting calculation tool for Eastern Regional Grid

Update and support activities 01/11/2021 – 31/10/2022

SCOPE OF WORK

- Activities
- New S/S Data Collection
- New Element Addition as per OCC meetings
- Data Updation in PSCT & PDMS
  - Training on Protection study & PDMS
  - Software Enhancement
  - Server Maintenance
  - DMNS Reporting
- Technical Analysis for Tripping Incidents

New S/S Data Collection

List of Substation visited

Sl. No.	SS Name	Voltage Level	Utility	State	Status
1	NEW JEERAT	765 kV	PMJTL	WEST BENGAL	Data Collection completed
2	BARUIPUR	220 kV	WBSETCL	WEST BENGAL	Data Collection completed
3	GOBINDPUR	220 kV	JUSNL	JHARKHAND	Data Collection completed
4	DHANBAD	220 kV	NKTL	JHARKHAND	Data Collection completed
5	CHATRA	220 kV	JUSNL	JHARKHAND	Data Collection completed
6	PATRATU	400 kV	JUSNL	JHARKHAND	Data Collection completed
7	SAHARSA	220 kV	PMTL	BIHAR	Data Collection completed
8	JAKKANPORE	400/220 kV	BGCL	BIHAR	Data Collection completed
9	NAUBATPUR	220 kV	BGCL	BIHAR	Data Collection completed
10	MOKAMAH	220 kV	BGCL	BIHAR	Data Collection completed
11	KARAMNASA	220 kV	BSPTCL	BIHAR	Data Collection completed
12	NPGCL	400 kV	NTPC	BIHAR	Data Collection completed
13	MERAMUNDALI B	400kV	OPTCL	ODISHA	Data Collection completed

List of Substation visited

Sl. No.	SS Name	Voltage Level	Utility	State	Status
14	OPGC	400kV	OPGC	ODISHA	DATA COLLECTION COMPLETED
15	RONGICHU	220kV	MBPCL	SIKKIM	DATA COLLECTION COMPLETED
16	JORETHANG	220kV	DANS ENERGY	SIKKIM	DATA COLLECTION COMPLETED
17	KHAMDONG	66kV	GOVT OF SIKKIM	SIKKIM	DATA COLLECTION COMPLETED
18	MARCHAK	66kV	GOVT OF SIKKIM	SIKKIM	DATA COLLECTION COMPLETED

New Element Addition as per OCC meetings

JUSNL(400/220kV)

Details of Element	HVCT	LVCT	NCT	CVT	TR	LINE LENGTH	CONDUCTOR TYPE	REACTOR	RELAY MAKE MODEL	RELAY SETTINGS	SLD
400KV TIE BAY OF NEW **RANCHI** -2 AND FUTURE AT **PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV MAIN BUS - 1 AT **PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400kV MAIN BAY OF 400/220KV 315MVA ICT-2 AT **PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
220kV MAIN BAY OF 400/220KV 315MVA ICT-2 AT **PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV-NEW **RANCHI-PATRATU-1**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

JUSNL(400/220kV)

DETAILS OF ELEMENT	HVCT	LVCT	NCT	CVT	TR	LINE LENGTH	CONDUCTOR TYPE	REACTOR	RELAY MAKE MODEL	RELAY SETTINGS	SLD
400KV-NEW **RANCHI-PATRATU-2**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV MAIN BUS-2 AT **PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV MAIN BAY OF NEW **RANCHI -2 AT PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV TIE BAY OF NEW **RANCHI -1** AND FUTURE AT **PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV MAIN BAY OF 400KV/220KV 315MVA ICT1 AT **PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV MAIN BAY OF 400KV/220KV 315 MVA ICT 1 AT **PATRATU**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

WBSETCL(400/220kV)

DETAILS OF ELEMENT	HVCT	LVCT	NCT	CVT	TR	LINE LENGTH	CONDUCTOR TYPE	REACTOR	RELAY MAKE MODEL	RELAY SETTINGS	SLD
400KV-GOKARNANEW CHANDITALA-1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV-**GOKARNANEW CHANDITALA-2**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
220 KV **RAJARHA**T (PG)-**BARASAT** (WB)-1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
220 KV **RAJARHAT** (PG)-**BARASAT** (WB)-2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
400KV-**GOKARNANEW CHANDITALA-1**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

POWERGRID(400/220/132kV)

DETAILS OF ELEMENT	HVCT	LVCT	NCT	CVT	TR	LINE LENGTH	CONDUCTOR TYPE	REACTOR	RELAY MAKE MODEL	RELAY SETTINGS	SLD
400/220KV 500MVA ICT-2 AT **MERAMUNDALI B**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

PSCT & PDMS Data Updation

Status for PDMS update2022

Sl. No.	SS Name	Voltage Level	Utility	State	Status
1	NEW JEERAT	765 kV	PMJTL	WEST BENGAL	DONE
2	BARUIPUR	220 kV	WBSETCL	WEST BENGAL	DONE
3	GOBINDPUR	220 kV	JUSNL	JHARKHAND	DONE
4	DHANBAD	220 kV	NKTL	JHARKHAND	DONE
5	CHATRA	220 kV	JUSNL	JHARKHAND	DONE
6	PATRATU	400 kV	JUSNL	JHARKHAND	DONE
7	SAHARSA	220 kV	PMTL	BIHAR	DONE
8	JAKKANPORE	400/220 kV	BGCL	BIHAR	DONE
9	NAUBATPUR	220 kV	BGCL	BIHAR	DONE
10	MOKAMAH	220 kV	BGCL	BIHAR	DONE
11	KARAMNASA	220 kV	BSPTCL	BIHAR	DONE
12	NPGCL	400 kV	NTPC	BIHAR	DONE
13	MERAMUNDALI B	400kV	OPTCL	ODISHA	DONE
14	RONGICHU	220 kV	MBPCL	SIKKIM	DONE
15	JORETHANG	220 kV	DANS ENERGY	SIKKIM	DONE

Status for PDMS update2022

Sl. No.	SS Name	Voltage Level	Utility	State	Status
16	OPGC	400 kV	OPGC	ODISHA	DONE
17	KHAMDONG	66 kV	GOVT OF SIKKIM	SIKKIM	DONE
18	MARCHAK	66kV	GOVT OF SIKKIM	SIKKIM	DONE

Training on PDMS & PSCT

Sl. No.	Date	State	Topic	Attended
1	24.08.2022	Bihar	PDMS	34
2	25.08.2022	Bihar	Protection Study	34
3	19.05.2022	West Bengal	PDMS	13
4	20.05.2022	West Bengal	Protection Study	13
5	26.05.2022	Jharkhand	PDMS	54
6	27.05.2022	Jharkhand	Protection Study	54
7	06.08.2022	Odisha	PDMS	14
8	07.09.2022	Odisha	Protection Study	14

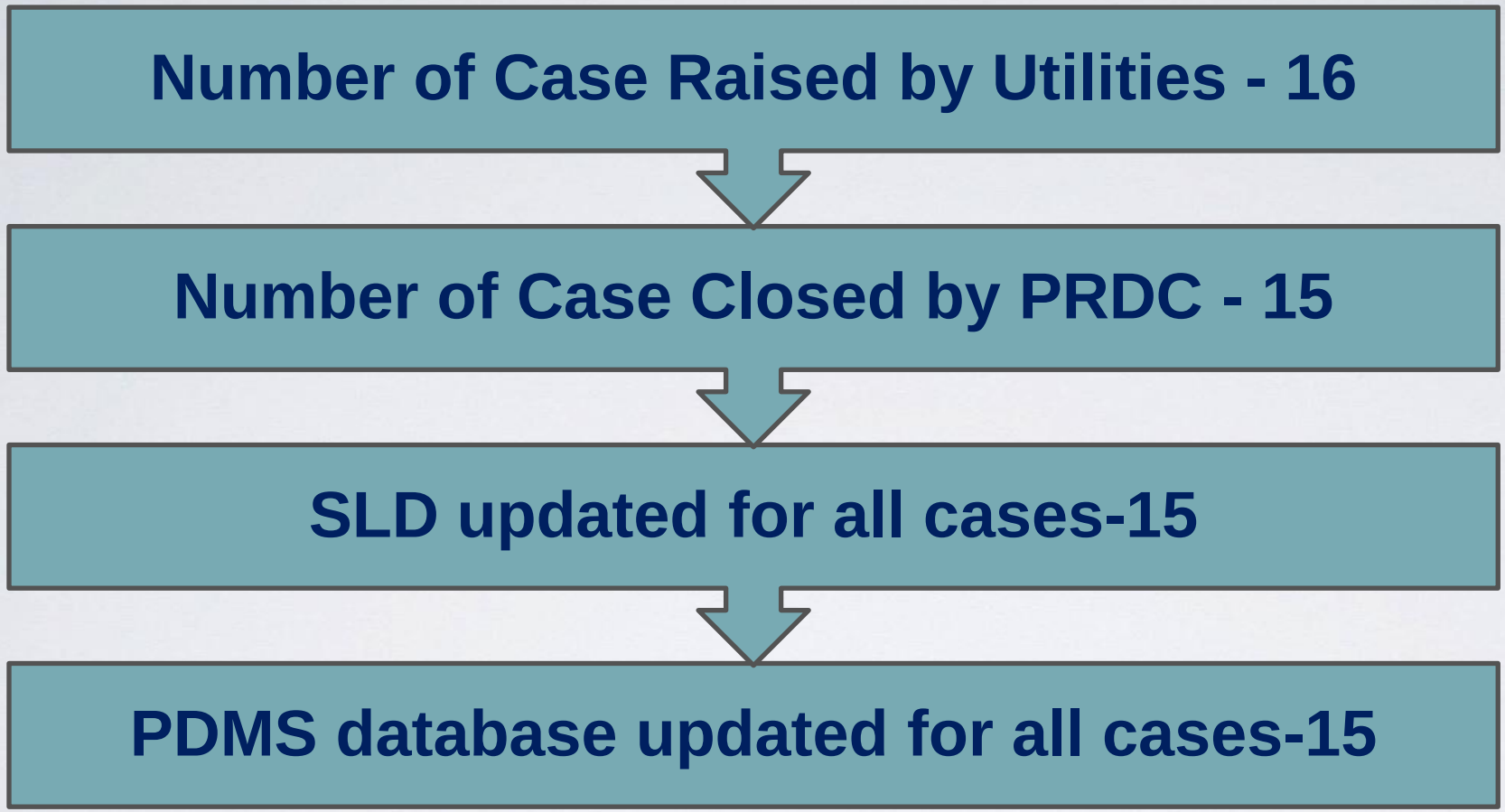
Software Update

- Introduction of favorite option
- Multiple relay data download simultaneously upto 25 Nos.
- CT, PT & CVT section added in report section of PDMS
- New feature for PDMS Relay Setting findings
- Multiple DR download facility on Tripping incident page
- Bug fixed for forgot password option on login page
- Working on New PDMS Dashboard
- Updation of Organization list
- New user addition
- Version Updates for PSCT
- Regular Power MAP updation of ER

Server Maintenance

- Regular Health check up for Live Server
- UPS backup activity checking for 40 min’s
- Regular Server Temp file/Cache clearing
- Regular Database storage backup of PDMS
- Internet Speed monitoring for Server
- Existing Firewall is replaced with the New Firewall

DMNS



Technical Services

- **Tripping analysis for Teesta V 400kV.**
- **Studies on total power failure at Tenughat.**
- **Distance Relay Calculation for the following**

1. Budhipadar Korba Line	7. Jharsuguda Ind-Bharat D/C Line	12. Lapanga Ariyan Ishpat Line
2. Budhipadar Lapanga Line	8. Jharsuguda Raigarh D/C Line	13. Lapanga SMC Line
3. Budhipadar Bhusan Line	9. Lapanga Budhipadar D/C Line	14. Lapanga Meramunduli D/C Line
4. Jharsuguda Angul D/C Line	10. Lapanga Burla D/C Line	15. Lapanga Ind-Bharat D/C Line
5. Jharsuguda Dharamjoygarh D/C Line	11. Lapanga Katapalli Line	16. Lapanga Starlight D/C Line
6. Tenughat Earth Fault Co-ordination		

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Thank You!