



Agenda
for
136th PCC Meeting

Date: 19.06.2024
Eastern Regional Power Committee
14, Golf Club Road, Tollygunge
Kolkata: 700 033

EASTERN REGIONAL POWER COMMITTEE

AGENDA FOR 136th PROTECTION COORDINATION SUB-COMMITTEE MEETING TO BE HELD ON 19.06.2024 AT 10:30 HRS THROUGH MS TEAMS

PART – A

ITEM NO. A.1: Confirmation of Minutes of 135th Protection Coordination sub-Committee Meeting held on 21st May 2024 at ERPC, Kolkata.

The minutes of 135th Protection Coordination sub-Committee meeting held on 21.05.2024 was circulated vide letter dated 13.06.2024

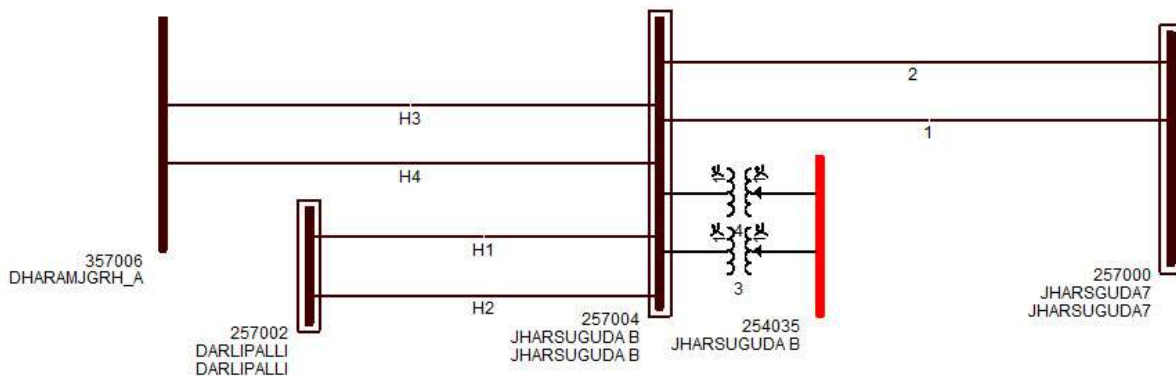
Members may confirm the minutes of the Meeting.

PART – B

ITEM NO. B.1: Disturbance at 765/400 kV Jharsuguda (Powergrid) S/s and tripping of units at Darlipalli STPP (NTPC) and OPGC on 21.05.2024 at 17:02 Hrs

On 21.05.2024, at 17:02 Hrs, 765 kV Bus Reactor-1 & 1500 MVA 765/400 kV ICT-1 at Jharsuguda tripped due to failure of tie bay CT at Jharsuguda. At the same time, 800 MW Unit 1 at Darlipalli tripped due to tripping of VFDs used for pulverisers which led to loss of fuel. Subsequently, Unit 3 and Unit 4 at OPGC also tripped one by one on low forward power.

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



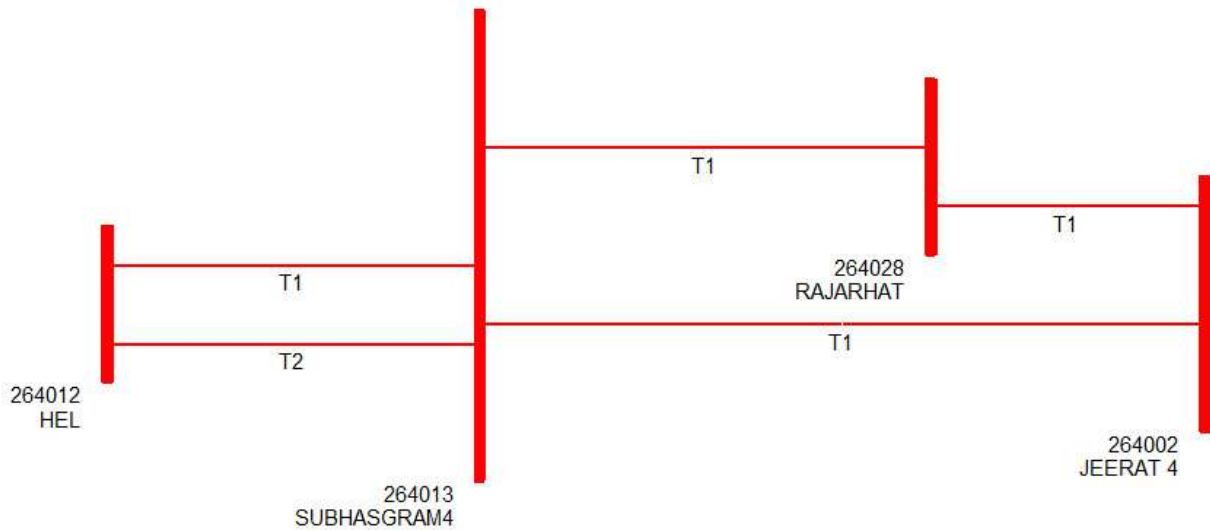
Gen. Loss: 1900 MW
Outage Duration: 01:48 Hrs

Powergrid Odisha, NTPC and OPGC may explain.

ITEM NO. B.2: Disturbance at 400 kV Haldia(HEL) S/s on 29.05.2024 at 12:38 Hrs

R phase bushing of GT-1 at Haldia caught fire which led to tripping of Unit-1 on operation of GT-1 transformer differential protection. At the same time, 400 kV Haldia-Subhashgram-2 got tripped due to fault in R phase LA & 400 kV Haldia-Subahshgram-1 also tripped due to E/F. Consequently, Unit 2 also tripped due to loss of evacuation path.

Disturbance report from ERLDC is attached at **Annexure B.2.**



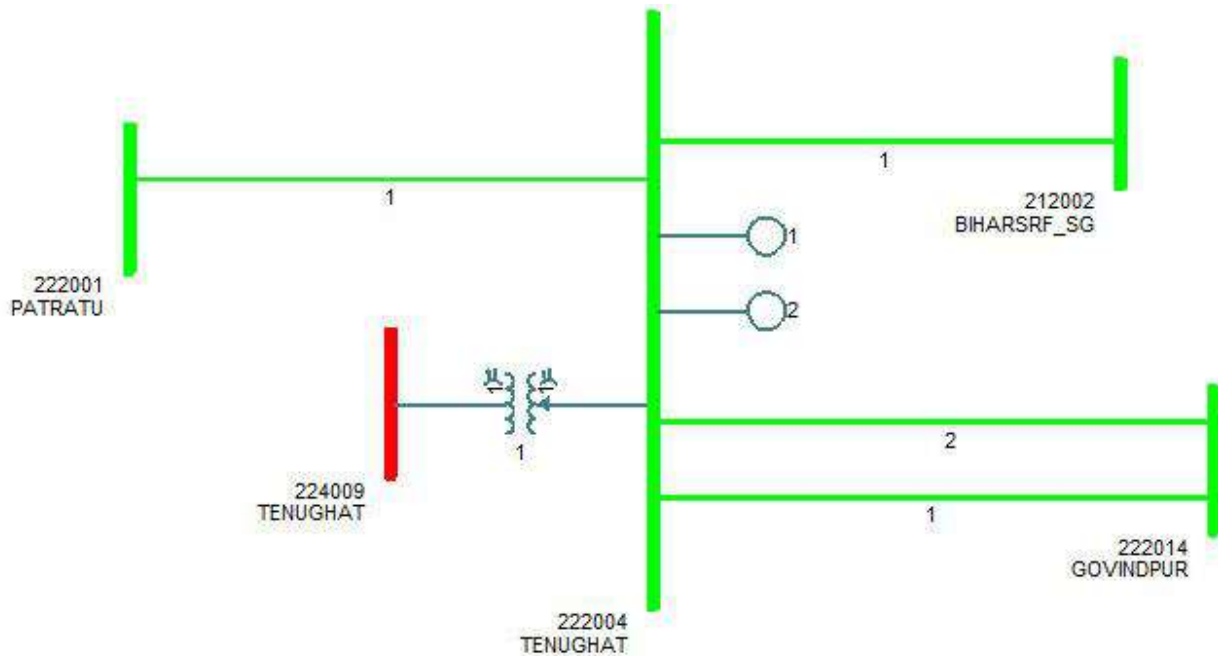
Gen. Loss: 566 MW

Outage Duration: 00:19 Hrs

HEL and Powergrid may explain.

ITEM NO. B.3: Disturbance at 220 kV Tenughat (TVNL) S/s on 29.05.2024 at 12:57 Hrs

On 29.05.2024, at 12:57 hrs 220 kV Tenughat-Govindpur-1 tripped due to Y-B Fault. 220 kV Tenughat Govindpur-2 also tripped at the same time from Tenughat only. As 220 kV Tenughat-Biharsharif was already was already under breakdown, both units of Tenughat got tripped subsequently due to loss of evacuation path.



Disturbance report from ERLDC is attached at **Annexure B.3.**

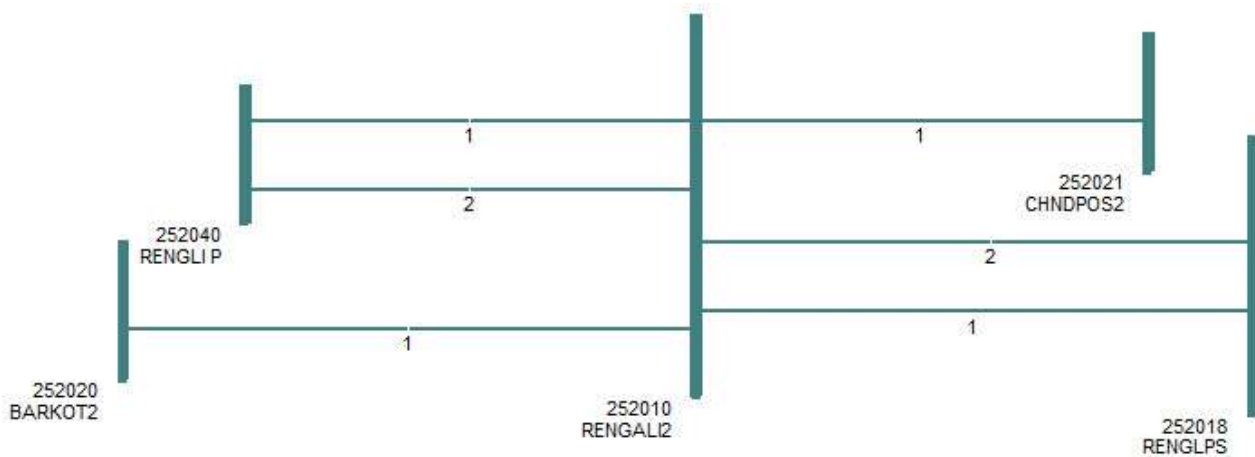
Gen. Loss: 333 MW
Outage Duration: 00:17 Hrs

TVNL may explain.

ITEM NO. B.4: Total Power Failure at 220 kV Chandiposh (OPTCL)S/s and 220 kV Barkot (OPTCL) S/s on 21.05.2024 at 18:09 Hrs

Y phase BPI of 220 kV Rengali-Rengali (PH)-1 punctured at Rengali end. At the same time, 220 kV Rengali-Rengali (PG) D/c, 220 kV Rengali-Chandiposh and 220 kV Rengali-Barkot also tripped. This led to total power failure at Chandiposh and Barkot S/s.

Disturbance report from ERLDC is attached at **Annexure B.4.**



Load Loss:40 MW
Outage Duration: 00:16 Hrs

OPTCL may explain.

ITEM NO. B.5: Total Power Failure at 220 kV Garaul(BSPTCL) S/s on 09.05.2024 at 08:02 Hrs

220kV Muzaffarpur-Garaul circuit 1 was under breakdown prior to the disturbance. At 08:02 hrs, 220kV Muzaffarpur-Garaul-2 tripped due to R-N fault which led to total power failure at Garaul.

Disturbance report from ERLDC is attached at **Annexure B.5.**

Load Loss:15 MW
Outage Duration: 03:00 Hrs

BSPTCL may explain.

ITEM NO. B.6: Disturbance at 220 kV Dalkhola (WBSETCL) S/s on 31.05.2024 at 02:42 Hrs

132 kV Bus PT got burst at Dalkhola(WB) and 132 kV Bus became dead. At the same time, 220 kV Dalkhola(PG)-Kishanganj D/c also tripped from Kshanganj in Zone-3. Consequently, 220 kV Dalkhola (WB) S/s became dead.

Disturbance report from ERLDC is attached at **Annexure B.6.**

Load Loss:4 MW
Outage Duration: 00:10 Hrs

WBSETCL may explain.

ITEM NO. B.7: Major grid events other than GD/GI

A) Bus tripping occurred in Eastern Region during April'24

Element Name	Tripping Date	Reason	Utility
765 kV Bus-2 at New Ranchi	11.05.2024 at 18:19 Hrs	-	PG ER-1

Powergrid may explain.

B) Repeated tripping of transmission lines during the month of May'24

S.No.	Name of the Element	No. of times Tripped	Remarks	Utility
1	220 kV Joda-Ramchandrapur-1	7	Fault in B_ph in 5 instances.	JUSNL/OPTCL
2	220 kV Daltoganj-Chatra-1	5	Y_B fault in three instances.	JUSNL

3	220 kV Rengali (PH)-TSTPP-1	4	Fault in R_ph in three instances.	OPTCL
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Concerned utilities may explain.

ITEM NO. B.8: Submission of protection performance indices on monthly basis by users to RPC and RLDC for 220 kV and above lines

As per IEGC 2023 Clause 15(6), 15(7) all users shall submit protection performance indices of previous month to ERPC and ERLDC along with reasons for performance indices less than unity of individual element wise protection system to the respective RPC and action plan for corrective measures. For the month of May'24, only WBSETCL has submitted the same, which is attached as **Annexure B.8**. Other utilities are requested to submit the details every month for necessary compliance.

Concerned utilities may update.

ITEM NO. B.9: Single Line Tripping Incidences in month of May 2024

Single line tripping incidents in the month of May 2024 which needs explanation from constituents of either end is attached at **Annexure B.9**.

Members may discuss

PART- C: OTHER ITEMS

ITEM NO. C.1: Protection Philosophy of Eastern Region

In 129th PCC Meeting, ERPC Secretariat pointed out the relevant clauses of IEGC 2023 regarding Protection code which will be in force w.e.f. 01.10.2023. He intimated that the existing protection philosophy of ER is not comprehensive and have not been reviewed since long. In compliance to the IEGC regulation and to form a comprehensive protection philosophy, it was suggested to form a committee of protection experts from state transmission utilities, Powergrid, NTPC/NHPC, IPPs as well as representative from SLDCs, ERLDC & ERPC secretariat to review the existing protection philosophy of ERPC and suggest necessary changes to be incorporated in the philosophy.

PCC agreed for the formation of committee as mentioned above and requested concerned utilities to nominate member from their respective organization.

Subsequently ERPC Secretariat vide email dated 26th Feb 2024 had shared draft protection philosophy to committee members which is attached. However, no comments have been received till date.

In 134th PCC Meeting, ERPC Secretariat informed that in compliance to the IEGC 2023, protection protocol for Eastern Region had been prepared. The same is attached at **Annexure C.1**.

NHPC representative submitted following observations:

- i. For 220 kV D/C lines, the zone-2 reach setting may be defined similar to the 400 kV Lines.
- ii. Zone-4 setting where busbar protection is not available may be set to 160 msec.
- iii. Overvoltage setting may be kept at the 220 kV lines at generating station end where line is having cable section. The settings will be coordinated with unit overvoltage setting.
- iv. Cases for which direct trip inter tripping command will be sent to remote end may be specified.

After discussion, PCC agreed for inclusion of point i, iii, and iv in the protection protocol.

PCC further advised all other utilities to go through the protocol and submit their observation at the earliest so that it can be finalized in next PCC Meeting.

In 135th PCC Meeting, Powergrid ER-II representative informed that he has few observations related to protection philosophy which will be shared by 24th May 2024.

PCC further advised all other utilities to go through the protocol and submit their observation by 28th May 2024 so that it can be finalized at earliest.

Members may discuss.

ITEM NO. C.2: Internal Protection Audit Plan of Sub stations for the Year 2024-25

The Clause (5) of Regulation 15 of IEGC Regulations, 2023 envisages as below:

Quote

(1) All users shall conduct internal audit of their protection systems annually, and any shortcomings identified shall be rectified and informed to their respective RPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with respective RPC for users connected at 220 kV and above (132 kV and above in NER).

(5) Annual audit plan for the next financial year shall be submitted by the users to their respective RPC by 31st October. The users shall adhere to the annual audit plan and report compliance of the same to their respective RPC."

Unquote

All utilities are requested to submit the annual audit plan for the substations 220kV and above voltage level for FY 2024-25 to ERPC by 31.10.2023. Annual audit plans for internal audit of their protection systems and third-party protection audit shall be furnished separately.

In 131st PCC Meeting, PCC advised all utilities to submit annual audit plan for the substations 220kV and above voltage level for FY 2024-25 to ERPC at earliest.

The audit plan was received from NHPC & JUSNL.

In 133rd PCC Meeting, It was informed that audit plan had been received from WBSETCL, NHPC and JUSNL.

OPTCL representative informed that detailed protection audit plan will be submitted soon. BSPTCL representative informed that during winter maintenance activities, protection audit of substations was done however it had not been done as per prescribed format. He further informed that detailed protection audit plan will be submitted soon.

PCC advised Powergrid, NTPC, DVC and IPPs to share their protection audit plan at the earliest.

In 134th PCC Meeting, ERPC representative informed that till date audit plan had been received from WBSETCL, NHPC, JUSNL, BSPTCL and PG Odisha.

PCC advised Powergrid (ER 1 and ER 2), NTPC, DVC and IPPs to share their protection audit plan at the earliest.

WBPDC representative enquired about the format to carry out protection audit. PCC decided that the prescribed format given in IEGC 2023 will be used to carry out protection audits. The format is also enclosed at **Annexure C.2**.

DVC and CESC have also submitted the protection audit plan to ERPC.

In 135th PCC Meeting, Member Secretary, ERPC advised remaining utilities to share protection audit plan to ERPC within two weeks.

Member Secretary, ERPC suggested that nodal officer from each utility shall be nominated so that protection audit plan other related matter can effectively be monitored.

Powergrid ER-1 representative informed that at present, audit for one substation is done on monthly basis and detailed plan will be shared within a week.

NTPC representative informed that as per present procedure, audit for each substation is done on two yearly basis. ERPC representative replied that as per IEGC 2023, internal audit of each substation needs to be done on yearly basis therefore audit for each of their generating station may be planned accordingly and the plan may be shared within a week.

Concerned Utilities are requested to submit the audit plan at the earliest.

ITEM NO. C.3: Follow-up of Decisions of the Previous Protection Sub-Committee Meeting(s)

The decisions of previous PCC meetings are attached at **Annexure C.3.**

Members may update the latest status.


ग्रिड-इंडिया
GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
 (भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
 (A Government of India Enterprise)
 [formerly Power System Operation Corporation Limited (POSOCO)]

पूर्वी क्षेत्रीय भार प्रेषण केन्द्र / Eastern Regional Load Despatch Centre

कार्यालय : 14, गोल्फ क्लब रोड, टॉलिंगंज, कोलकाता - 700033
 Office : 14, Golf Club Road, Tollygunge, Kolkata - 700033
 CIN : U40105DL2009GOI188682, Website : www.erfdc.in, E-mail : erfdinfo@grid-india.in, Tel.: 033 23890060/0061

पूर्वी क्षेत्र के 220/132 केवी प्रताप सासन उप-केन्द्र में ग्रिड घटना पर विस्तृत रिपोर्ट / Detailed Report of grid event at 765/400 kV Jharsuguda, Pratapsasan S/s of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))

(आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):05-06-2024

1. Event Summary (घटना का सारांश):

At 17:02 Hrs on 21.05.2024, 765 kV Bus Reacotr-1 & 1500 MVA 765/400 kV ICT-1 at Jharsuguda tripped due to failure of the tie bay CT at Jharsuguda. At the same time, 800 MW U#1 at Darlipalli tripped due to tripping of VFDs used for pulverisers which led to loss of fuel. Subsequently, U#3 and U#4 at OPGC also tripped one by one on low forward power. Total generation loss of around 1900 MW occurred within a span of 3 minutes.

2. Time and Date of the Event (घटना का समय और दिनांक): 17:02 hrs of 21-05-2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Incident (GI)-2

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): Odisha

5. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
Pre-Event (घटना पूर्व)	50.09 Hz	30391 MW	25500 MW	3098 MW	5530 MW
Post Event (घटना के बाद)	49.98 Hz	28490 MW	25337 MW	1948 MW	5393 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद है	Nil
Weather Condition (मौसम स्थिति)	Inclement weather around Jharsuguda

6. Load and Generation loss (लोड और जनरेशन हानि): Generation loss: Approx. 1900 MW (in succession); Load loss: Nil

7. Duration of interruption (रूकावट की अवधि): 01:48 Hrs

8. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

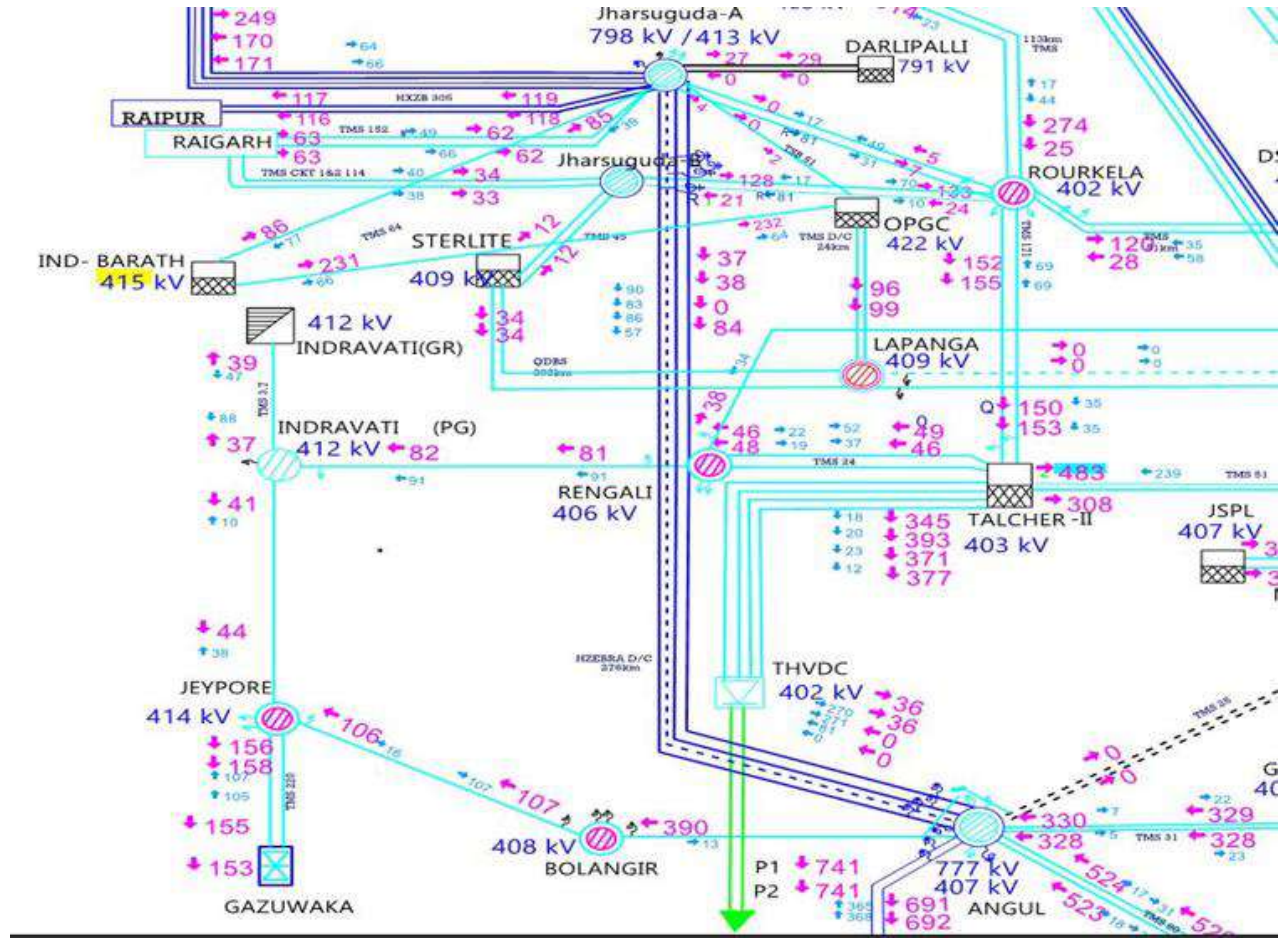


Figure 1: Network across the affected area

9. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): 765 kV R_ph and Y_ph CT of tie bay of 240 MVar Bus reactor-1 and 765/400 kV ICT-1 at Jharsuguda failed.

10. Major Elements Tripped (प्रमुख ट्रिपिंग):

क्र०स०	नाम	Trip time (hh:mm:ss)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	240 MVar Bus Reactor-1 at Jharsuguda	17:02:01	Differential protection Operated		18:51
2	1500 MVA 765/400 kV ICT-1 at Jharsuguda		765 kV Tie Bay LBB operated		18:50

3	765 kV Jhasuguda-Darlipalli-2	17:02:01	Jhasuguda: Didn't trip	Darlipalli: R-Y, Zone-1,	19:12
4	800 MW U#2 at Darlipalli	17:02:12	Boiler Tripped. Loss of all fuel, MFT Trip		23:36
5	660 MW U#3 at OPGC	17:04:43	Low forward power		20:13
6	660 MW U#4 at OPGC	17:04:24	Low forward power		23:30

11. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- At 17:02:01.520 Hrs, differential protection of 240 MVAr Bus Reactor-1 operated at Jhasuguda due to failure of R_ph and Y_ph CT of its tie bay. However, even after opening of main and tie bay CB of Bus Reactor, fault still persisted as location of CT was on the other side of TB and ICT-1 which is this dia, kept feeding the fault. This led to operation of LBB of the tie CB at 17:02:01.750 Hrs and ICT-1 tripped from both HV and LV side and fault was cleared.
- At 17:02:01.700 Hrs, 765 kV Jhasuguda-Darlipalli-2 tripped from Darlipalli end as it detected the above fault in Zone-1.
- Subsequently at 17:02:12 Hrs, 800 MW U#2 at Darlipalli tripped due to tripping of Boiler on loss of all fuel. As reported, drives for coal pulveriers tripped on undervoltage. Undervoltage setting is as follows: U/V <65% for 300 msec.
- At 17:04:24 Hrs, 660 MW U#4 at OPGC tripped on Low forward power and 17:04:43 Hrs, 660 MW U#3 at OPGC tripped on low forward power as turbines of both units tripped.

12. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- Protection setting of auxiliary drives at Darlipalli is kept on conservative side which led to unnecessary tripping of U#2.
- Both units at OPGC tripped on low forward power one by one. OPGC may explain the reason and take necessary action to avoid unit tripping on such external faults which was cleared within 300 msec.

13. Action Taken/Remedial Measures (सुधारात्मक उपाय):

- Protection setting of auxiliary drives at Darlipalli needs to be reviewed.

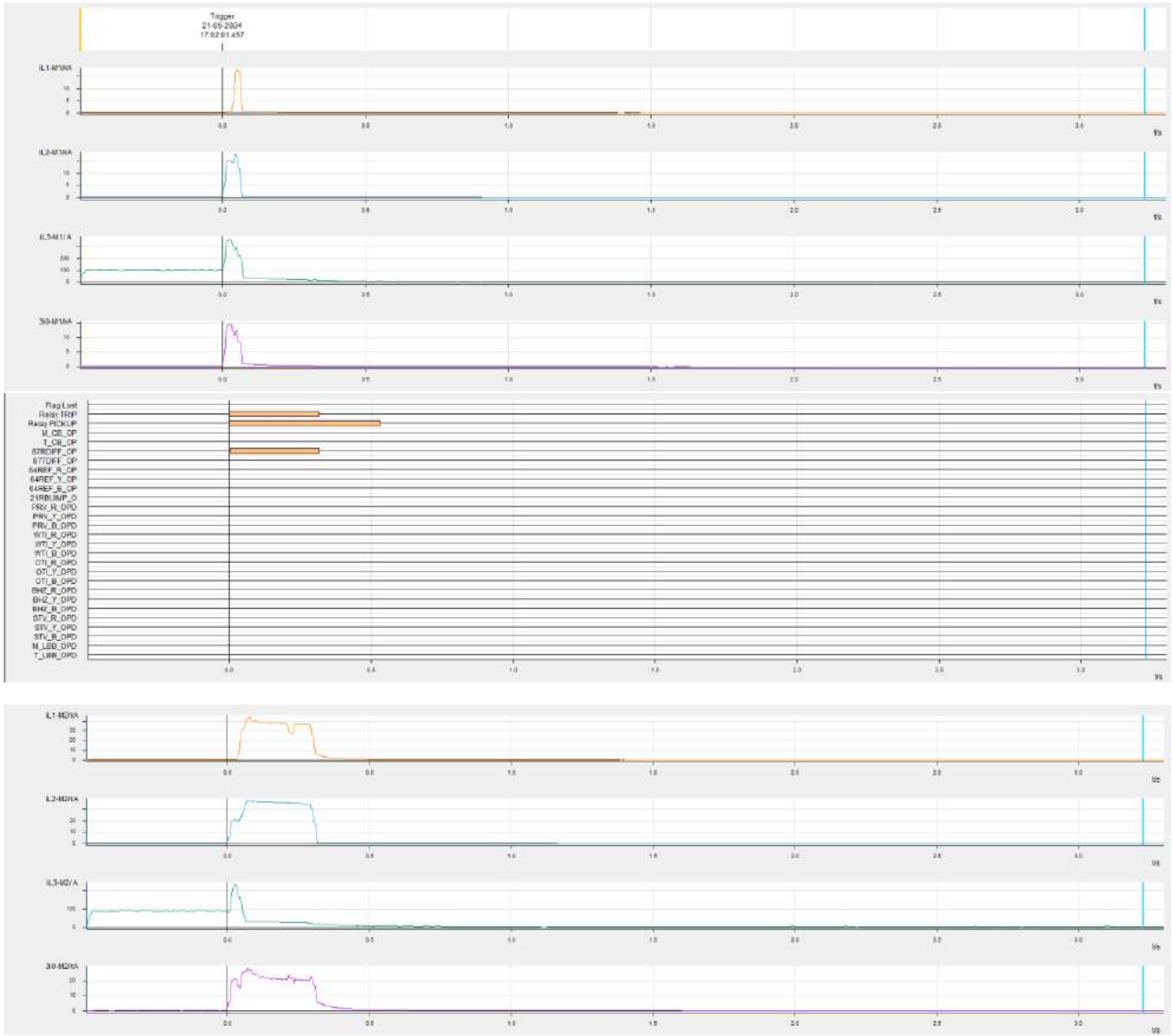
14. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA):

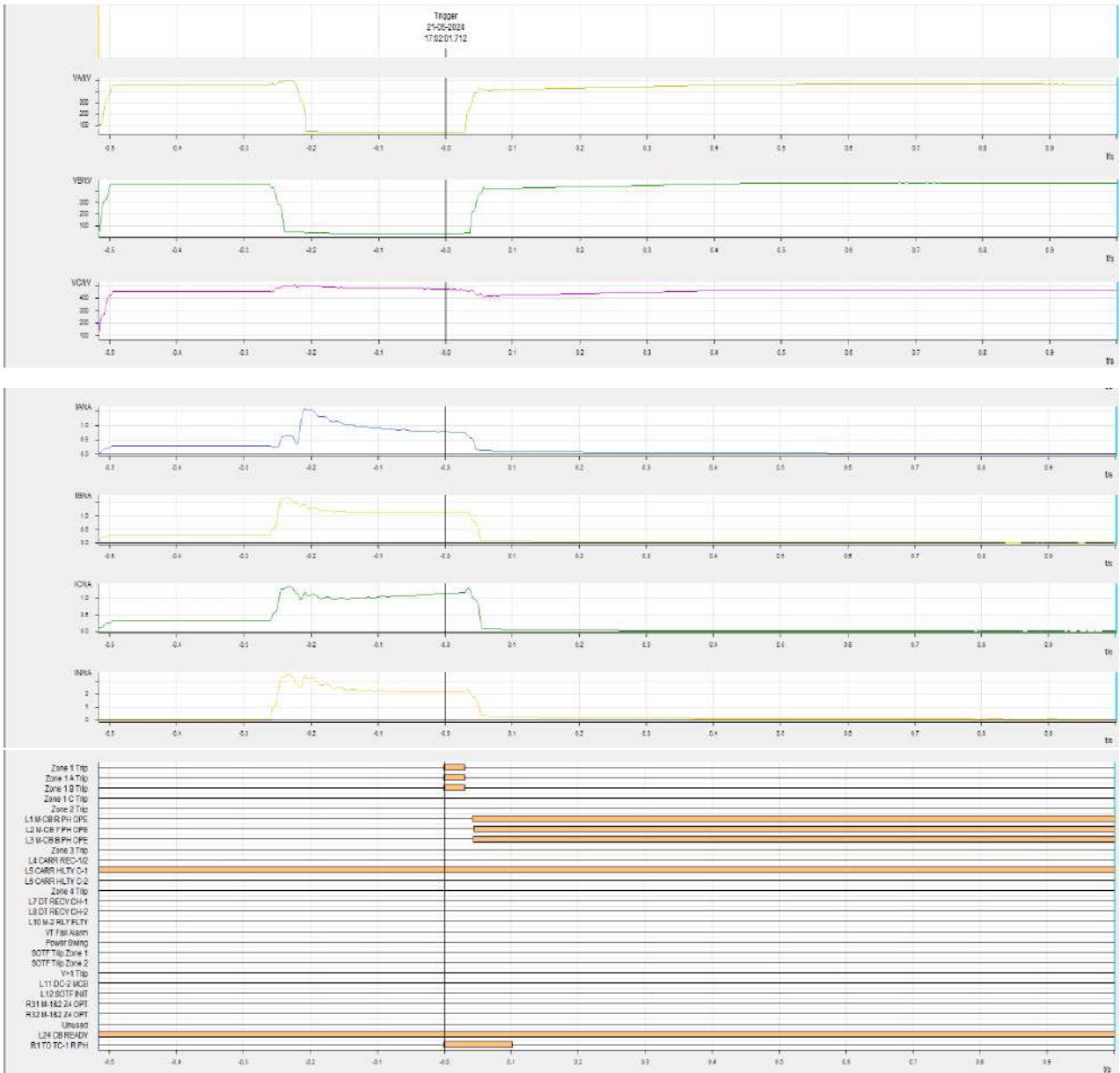
TIME	STATION	DESCRIPTION	STATUS
17:02:01.457	JHRS2_PG	765_Main_Bus_R3_DFP	Operated
17:02:01.712	DSTPP_PG	765_JHARS_PG_2_MP2	Operated
17:13:53.000	DSTPP_PG	765_JHARS_PG_2_MP1	Operated
17:02:01.746	DSTPP_PG	765_JHARS_PG_1_Main_CB	Open
17:02:01.750	DSTPP_PG	765_JHARS_PG_2_Main_CB	Open
17:02:01.753	JHRS2_PG	400_ICT1_Main_CB	Open
17:02:01.790	JHRS2_PG	400_RAIGR_WR_2_ICT1_Tie	Open
17:02:01.821	JHRS2_PG	765_Main_Bus_R1_Main_CB	Open
17:02:01.898	JHRS2_PG	765_ICT1_Main_CB	Open
17:02:02.007	JHRS2_PG	765_ICT1_Main_Bus_R1_Tie	Open
17:02:11.886	DSTPP_PG	765_GT_2_JHARS_PG_2_Tie	Open

Annexure 2:

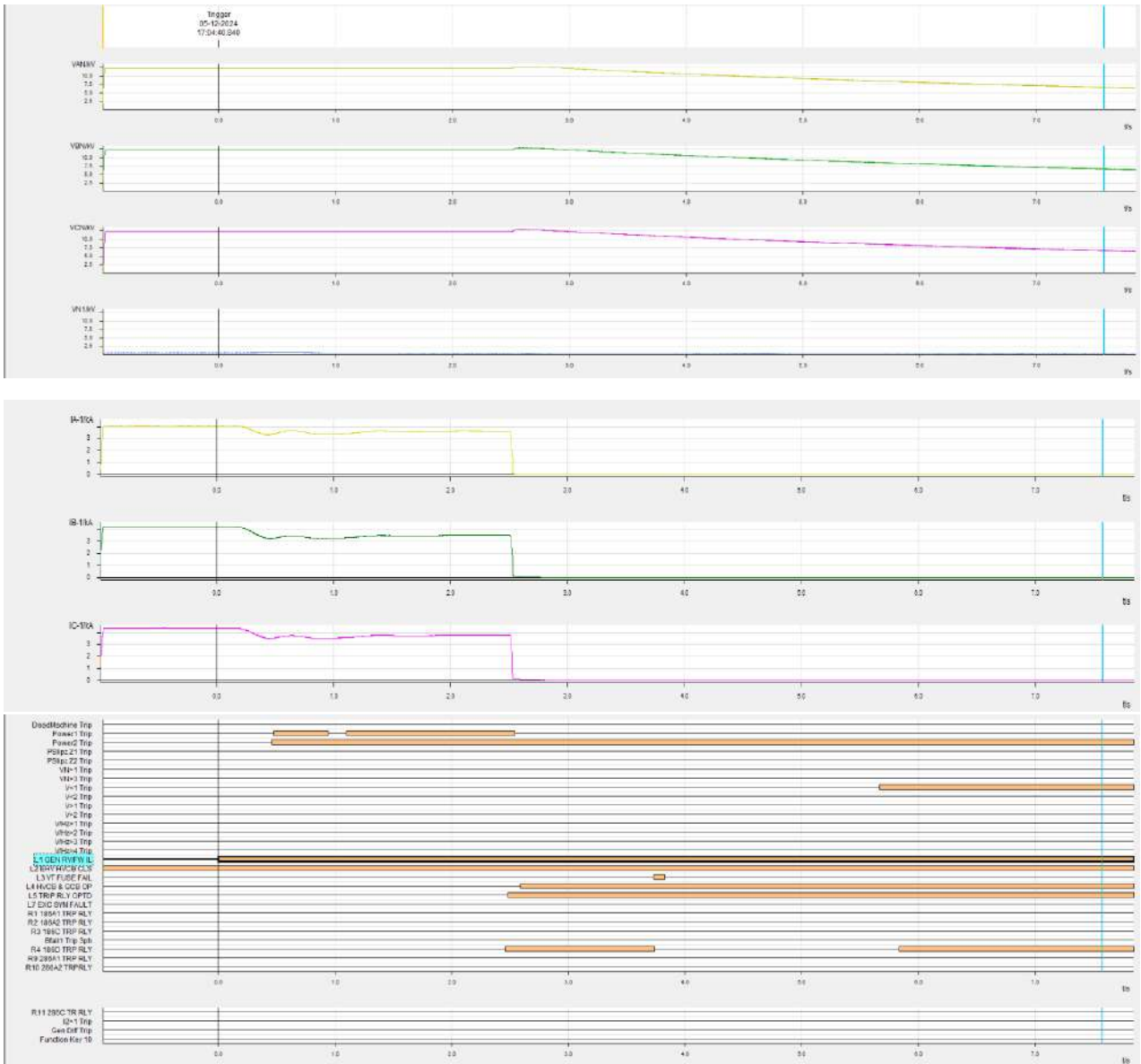
DR of Bus reactor-1 at Jharsuguda



DR of 765 kV Jharsuguda-Darlipalli-2 (Darlipalli)



DR of 660 MW U#3 at OPGC



Report on Multiple Elements Tripping on Dt. 21.05.2024 at Sundargarh SS

Background:

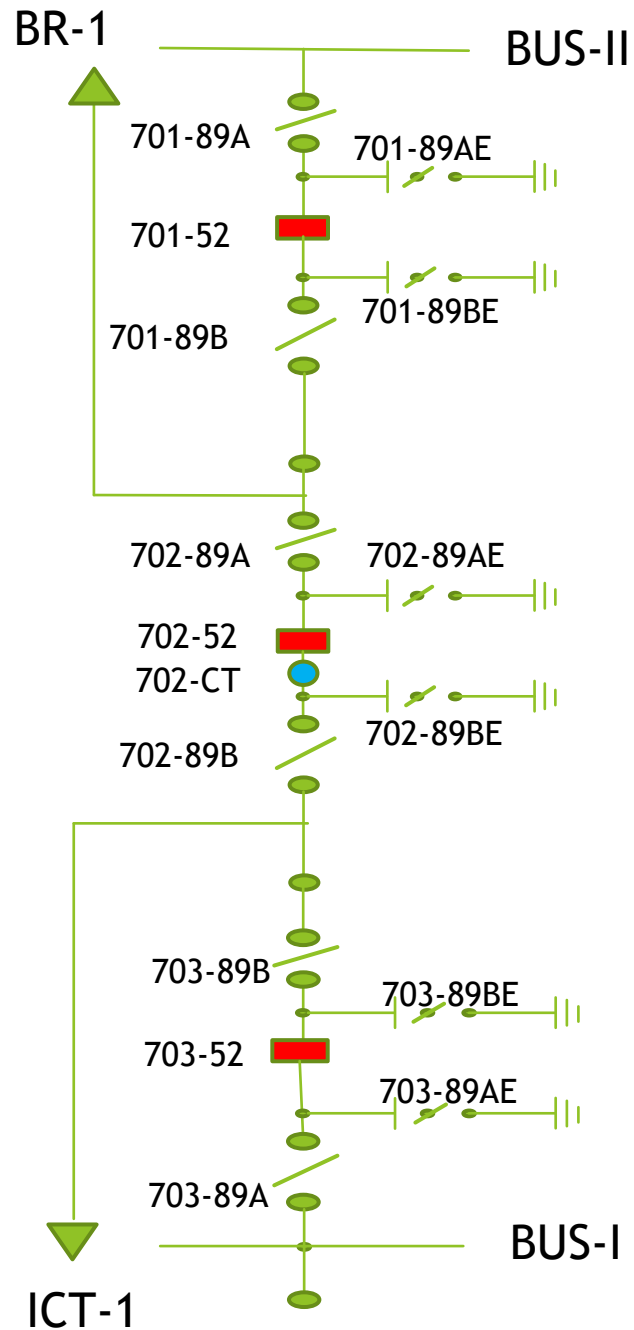
At Sundargarh SS very heavy lightning & thunderstorm observed from 16:30 hrs for 1 hr on 21-05-2024. During thunderstorm following elements got tripped-

- i. 765kV Sundargarh-Angul ckt#4 tripped at 16:53:49 hrs.
- ii. 765kV Bus Reactor-1 tripped at 17:02:01:482 hrs
- iii. 765/400kV ICT-1 tripped at 17:02:01:718 hrs.

Tripping details of 765kV Sundargarh-Angul ckt#4:

- 765kV Sundargarh-Angul ckt#4 tripped at 16:53:49 hrs on 21-05-2024 due to
- persistent B-G fault at a distance of 0.9KM from Sundargarh end. Fault Current
- Was 28.56kA.
- Line is restored at 18:12 hrs
- B-ph is bottom conductor.
- Flashover noticed in B-ph conductor between loc 786-787 (crossing 400kV LILO-1 i.e. Rourkela-1 & Raigarh-1).
- Clearance measurement is being done.





Tripping details of 765kV BR-1 & ICT-1:

- 701- MAIN BAY OF 765KV BUS REACTOR-1
- 702- TIE BAY OF BR-1 & ICT-1
- 703- MAIN BAY OF 765kV Side of ICT-1
- 403- MAIN BAY OF 400kV Side of ICT-1
- 402- TIE BAY OF ICT-1 & Raigarh#2

SEQUENCE OF Events:

17:02:01:482 Due to R & Y Ph CT failure, Differential current of 18kA detected by Bus Reactor Differential protection. Hence differential protection operated & actuate the Group Relays of 701(Main bay) & 702(Tie Bay). Hence Bus Reactor tripped.

17:02:01:682 702 breaker was open but fault current still flowing through the bay 703, 403 & 402 bays. 3-ph LBB initiation was already there. So after 200msec of fault, LBB protection operated & tripped CB-703, CB-403 & CB-402.

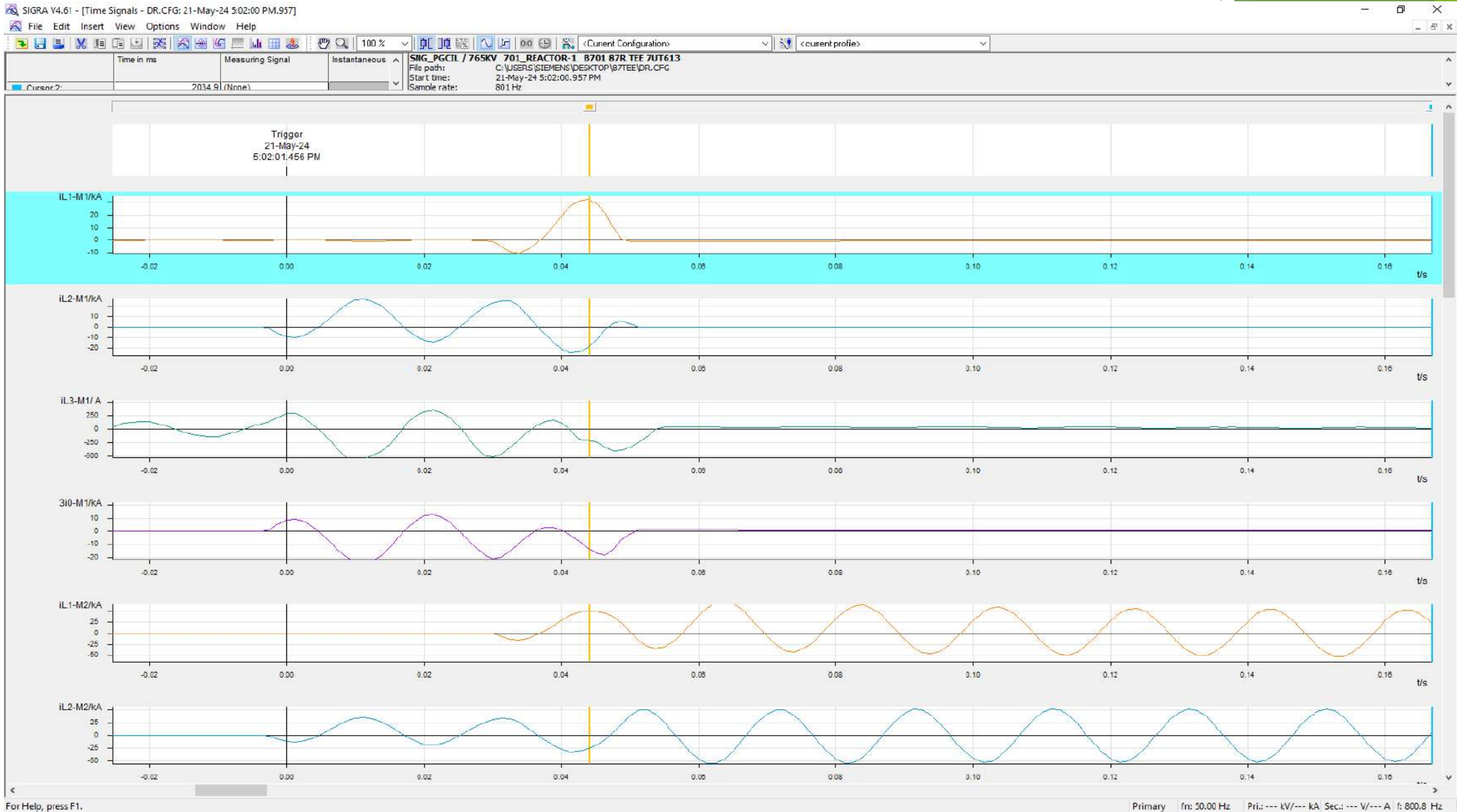
Hence Tripped ICT-1 & isolate the fault.



- Both the suspected damaged CTs are below the shield wire.
- Few 400kV CTs were failed in 2023 due to lightning and earthing audit done in Apr 2024. Report awaited.



DR OF BUS REACTOR DIFFERENTIAL RELAY:

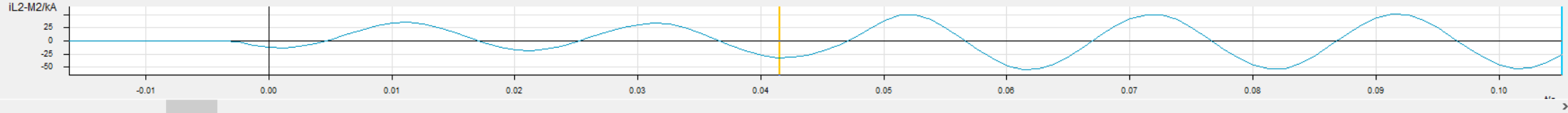
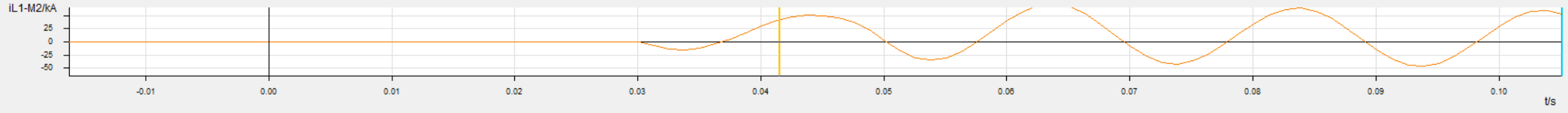
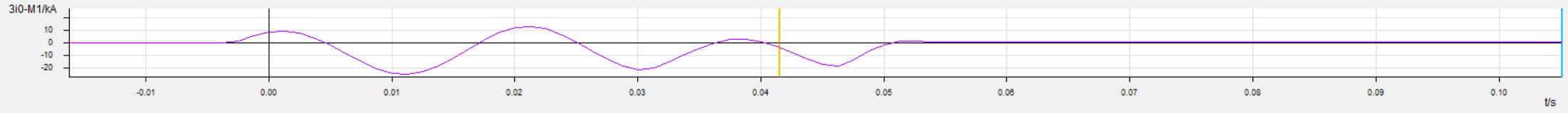
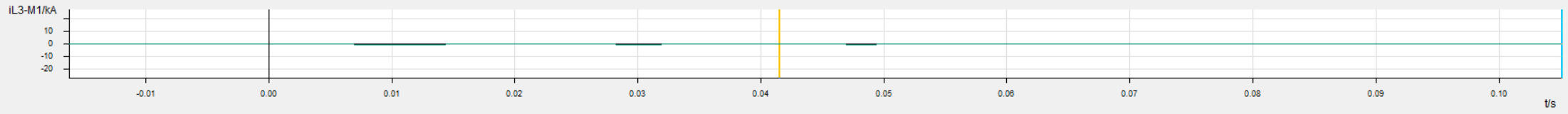
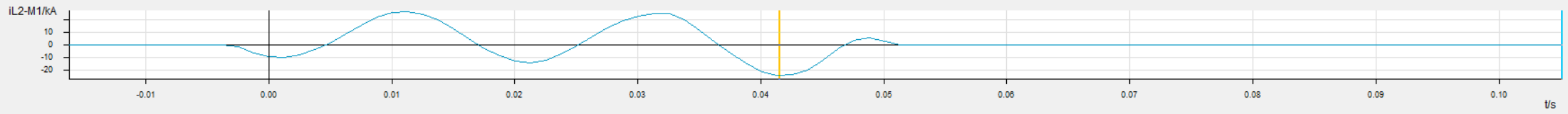
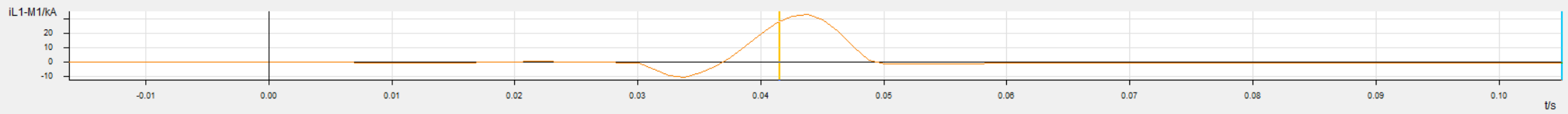


Windows taskbar showing the Start button, search icon, task view icon, and several application icons including Tardis..., DVD R..., 87TEE, 87TEE, This PC, DIGSI..., EnerVi..., Report, MiCO..., 10.22.9..., SCE5.1..., DS Agi..., PGCIL..., Untitle..., SIGRA..., and system tray icons for volume, network, and time (10:40 PM Tuesday 21-May-24).

Time in ms	Measuring Signal	Instantaneous
Cursor 2: 2034.9	(None)	

SNG_PGCIL / 765KV 701_REACTOR-1 B701 87R TEE 7UT613
File path: C:\USERS\SIEMENS\DESKTOP\87TEE\DR.CFG
Start time: 21-May-24 5:02:00.957 PM
Sample rate: 801 Hz

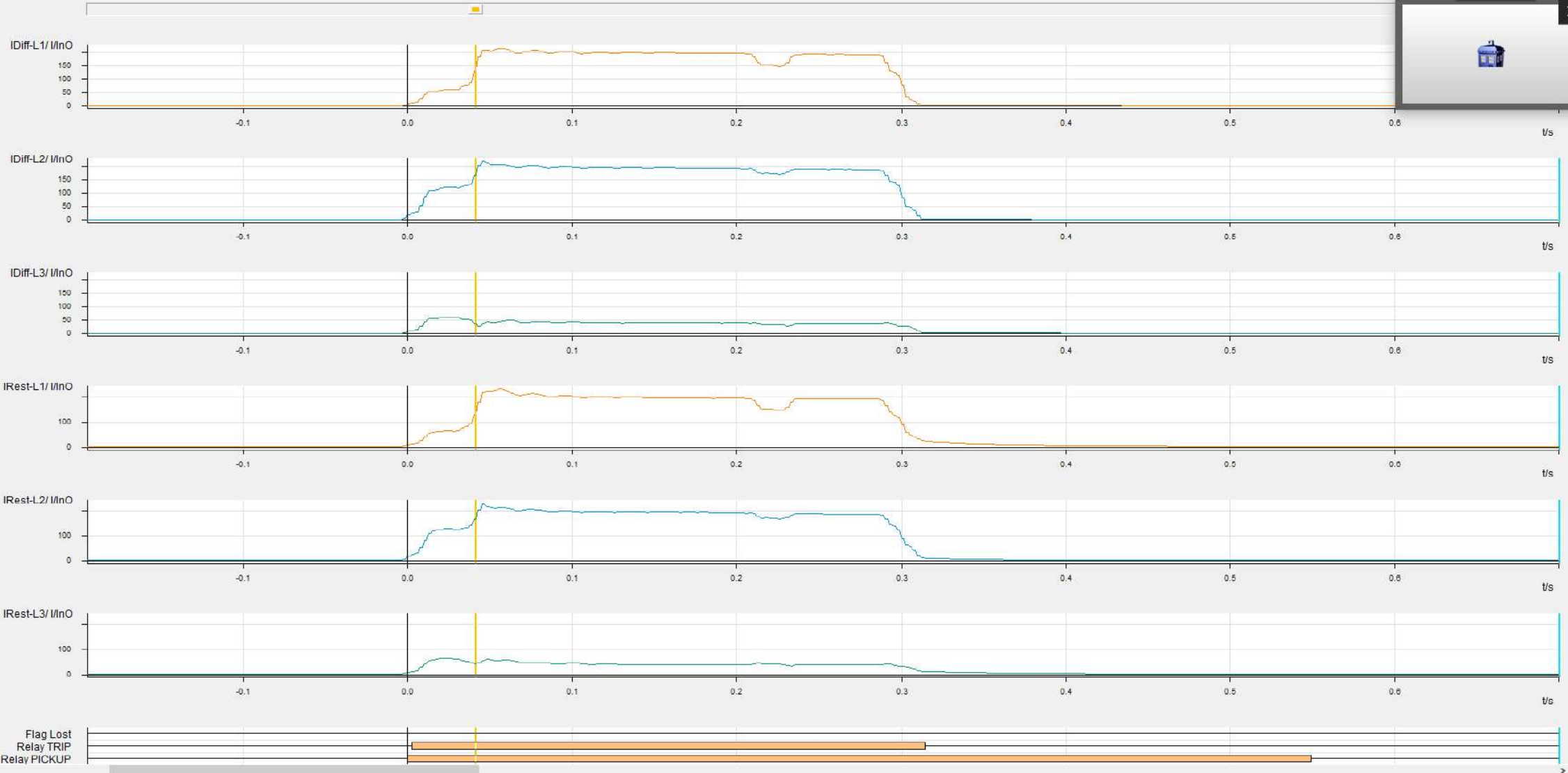
Trigger
21-May-24
5:02:01.456 PM



Windows taskbar showing system tray icons (network, volume, battery), taskbar icons (Tardis, DVD, 87TEE, 87TEE, This PC, DIGSI, EnerVi, Report, S1, 10.22.9..., SCE5.1..., DS Agi..., PGCIL..., Untitle..., SIGRA), and system clock (10:43 PM Tuesday 21-May-24).

Time in ms	Measuring Signal	Instantaneous
2034.9	(None)	

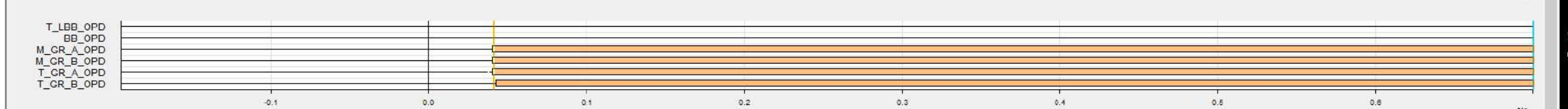
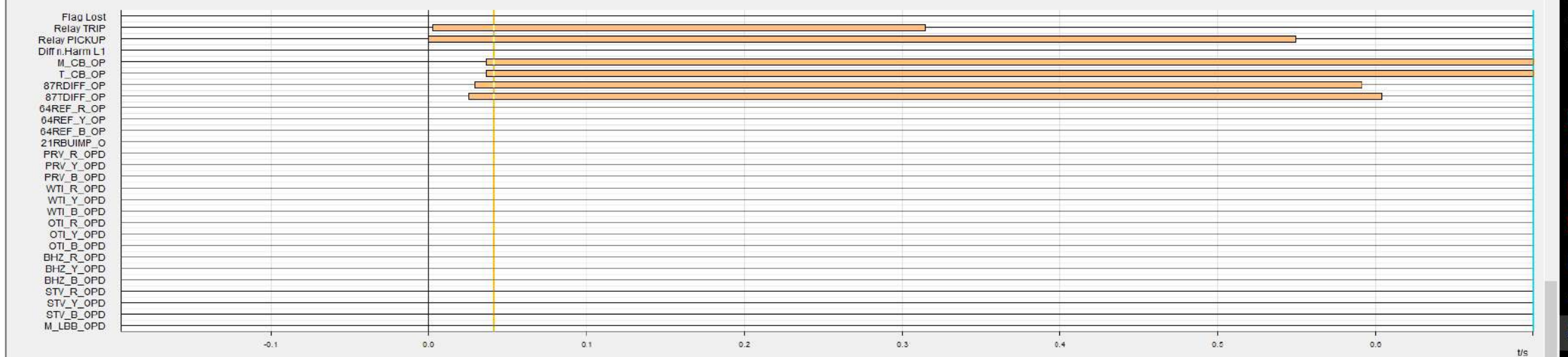
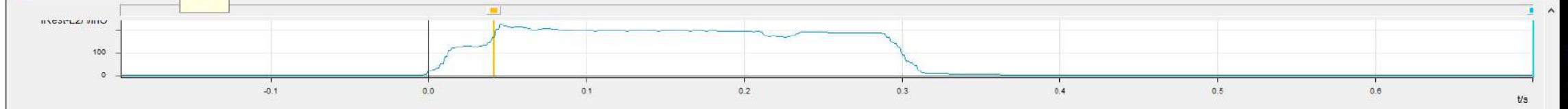
SNG_PGCIL / 765KV 701_REACTOR-1 8701 87R TEF 7UT613
File path: C:\USERS\SIEMENS\DESKTOP\87TEE\DR.CFG
Start time: 21-May-24 5:02:00.957 PM
Sample rate: 801 Hz



Windows taskbar showing system tray icons and application shortcuts: Tardis..., DVD R..., 87TEE, This PC, DIGSI..., EnerVi..., Report, MiCO..., 10.22.9..., SCE5.1..., DS Agi..., PGCIL..., Untitle..., SIGRA ...

System clock: 10:44 PM Tuesday 21-May-24

Time in ms Measuring Signal Instantaneous SNG_PGCL / 765KV 701_REACTOR-1 B701 87R TEE 7UT613
File path: C:\USERS\SIEMENS\DESKTOP\87TEE\DR.CFG
Start time: 21-May-24 5:02:00.957 PM
Sample rate: 801 Hz



Windows taskbar with icons for Tardis, DVD, 87TEE, This PC, DIGSI, EnerV, Report, MiCO, 10.22.9, SCE3.1, DS Agi, PGCL, Untitled, SIGRA, and system tray showing 10:45 PM Tuesday 21-May-24.

DR OF Tie LBB Relay:




ग्रिड-इंडिया
GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
 (भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
 (A Government of India Enterprise)
 [formerly Power System Operation Corporation Limited (POSOCO)]

पूर्वी क्षेत्रीय भार प्रेषण केन्द्र / Eastern Regional Load Despatch Centre

कार्यालय : 14, गोल्फ क्लब रोड, टॉलिंगंज, कोलकाता - 700033
 Office : 14, Golf Club Road, Tollygunge, Kolkata - 700033
 CIN : U40105DL2009GOI188682, Website : www.erfdc.in, E-mail : erfdinfo@grid-india.in, Tel.: 033 23890060/0061

पूर्वी क्षेत्र के 400/220 केवी उप-केन्द्र में ग्रिड घटना पर विस्तृत रिपोर्ट / Detailed Report of grid event in 400 kV Haldia TPS of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))
 (आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):14-06-2024

1. Event Summary (घटना का सारांश):

At 12:34 hrs., GT-1 at Haldia caught fire due to fault in 400 kV R Phase bushing. Resulting in tripping of Unit-1 due to operation of GT-1 Transformer Differential. At the same time, 400 kV circuit-2 tripped due fault in R phase LA & 400 kV circuit-1 tripped due to E/F. As a result of the outage of both 400 kV circuits, Unit-2 tripped due to over frequency and resulted in a generation loss of about 566 MW.

2. Time and Date of the Event (घटना का समय और दिनांक): 12:34 hrs of 29.05.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): West Bengal

5. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
				West Bengal	West Bengal
Pre-Event (घटना पूर्व)	49.96 Hz	25886 MW	28256MW	5975 MW	9965 MW
Post Event (घटना के बाद)	49.96 Hz	25320 MW	28256MW	5409 MW	9965 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	NA
Weather Condition (मौसम स्थिति)	Normal weather

6. Load and Generation loss (लोड और जनरेशन हानि): Generation loss: 566 MW; Load loss: NIL.

7. Duration of interruption (रूकावट की अवधि): 00:46 Hrs

8. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

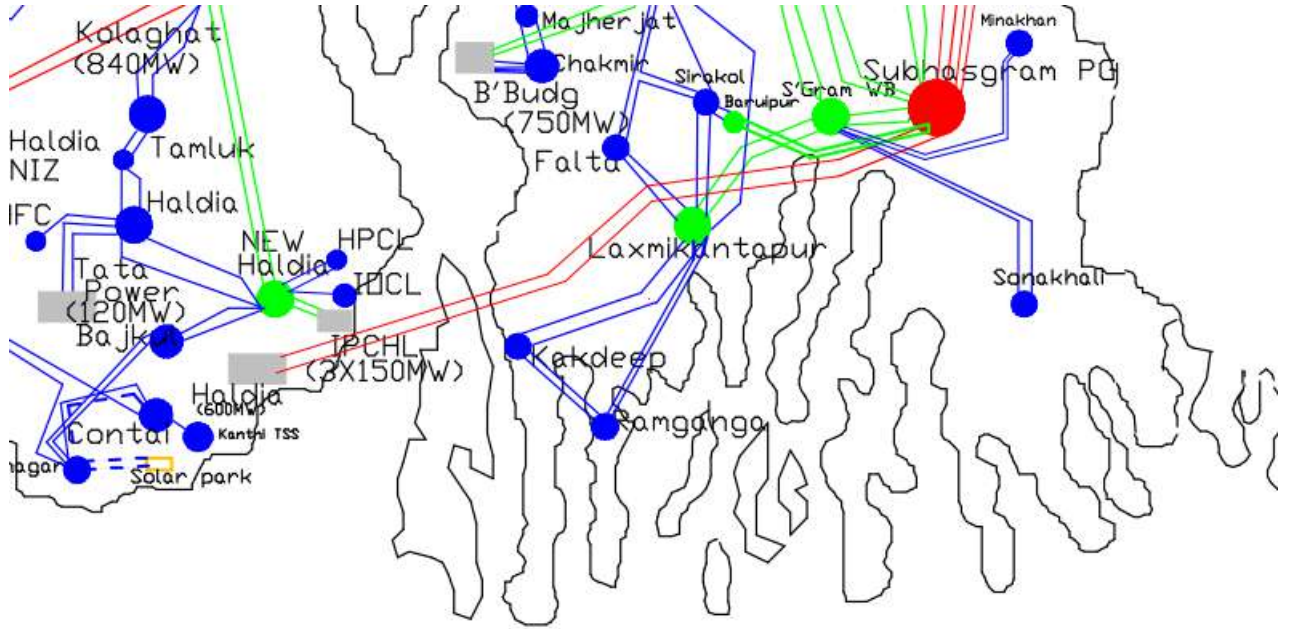


Figure 1: Network across the affected area

9. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): NA

10. Major Elements Tripped (प्रमुख ट्रिपिंग)

क्र०सं०	नाम	Trip time (hh:mm:ss)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	400KV-Subhasgram -Haldia-2	12:34:04	Subhasgram : R-N , - 63.71 KM , FC - 4.70 kA	Haldia: R_N, 9.59 kA, A/r failed	22:37
2	350 MW U#1 at Haldia		GT differential protection operated. R_ph bushing of GT caught fire.		Not revived yet.
	400KV-Subhasgram -Haldia-1	12:34:05	Subhasgram: R-N - 76.31 KM , FC - 5.63 kA	Haldia: DEF operated, In: 0.7 kA	13:20
4	350 MW U#2 at Haldia	12:34:06	Haldia: Loss of evacuation path		20:25

11. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- **At 12:34:04.840 Hrs:** As reported, R_ph LA of 400 kV Haldia-Subhashgram-2 failed at Haldia which was seen by both distance and differential relay at Haldia and R_ph breaker got opened from both ends. A/r attempted after 1 second but line tripped due to persisting fault.
- **At 12:34:05.840 Hrs:** During A/r attempt of Ckt-2, R_ph of 400 kV Haldia-Subahshgram-1 opened from Subhashgram end in Zone-1. Breakers at Haldia remained closed. Current was flowing through only two phase which led to increase in residual current to around 750 A.
- **At 12:34:05.850 Hrs:** GT differential protection operated due to fire in its R_ph bushing and U#1 tripped.
- **At 12:34:06.550 Hrs:** 400 kV Haldia-Subhashgram-1 tripped from Haldia.
- **At 12:34:06.850 Hrs:** Other two phase of 400 kV Haldia-Subahshgram-1 tripped from Subhashgram end.
- Haldia U#2 tripped due to loss of evacuation path.

PMU Snapshot:



Figure 2: PMU Voltage snapshot of 400 kV Subhasgram S/S

12. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- 400 kV Haldia-Subhashgram-1 tripped from Subhahsgram end in Zone-1 despite fault being in its Zone-2. Reason for overreaching may be analyzed by Powergrid.

13. Action Taken/Remedial Measures (सुधारात्मक उपाय):

- Zone reach settings at Subhashgram may be reviewed.

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

S.No.	Issues	Regulation Non-Compliance	Utilities
2.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	Haldia, POWERGRID (ER-II)

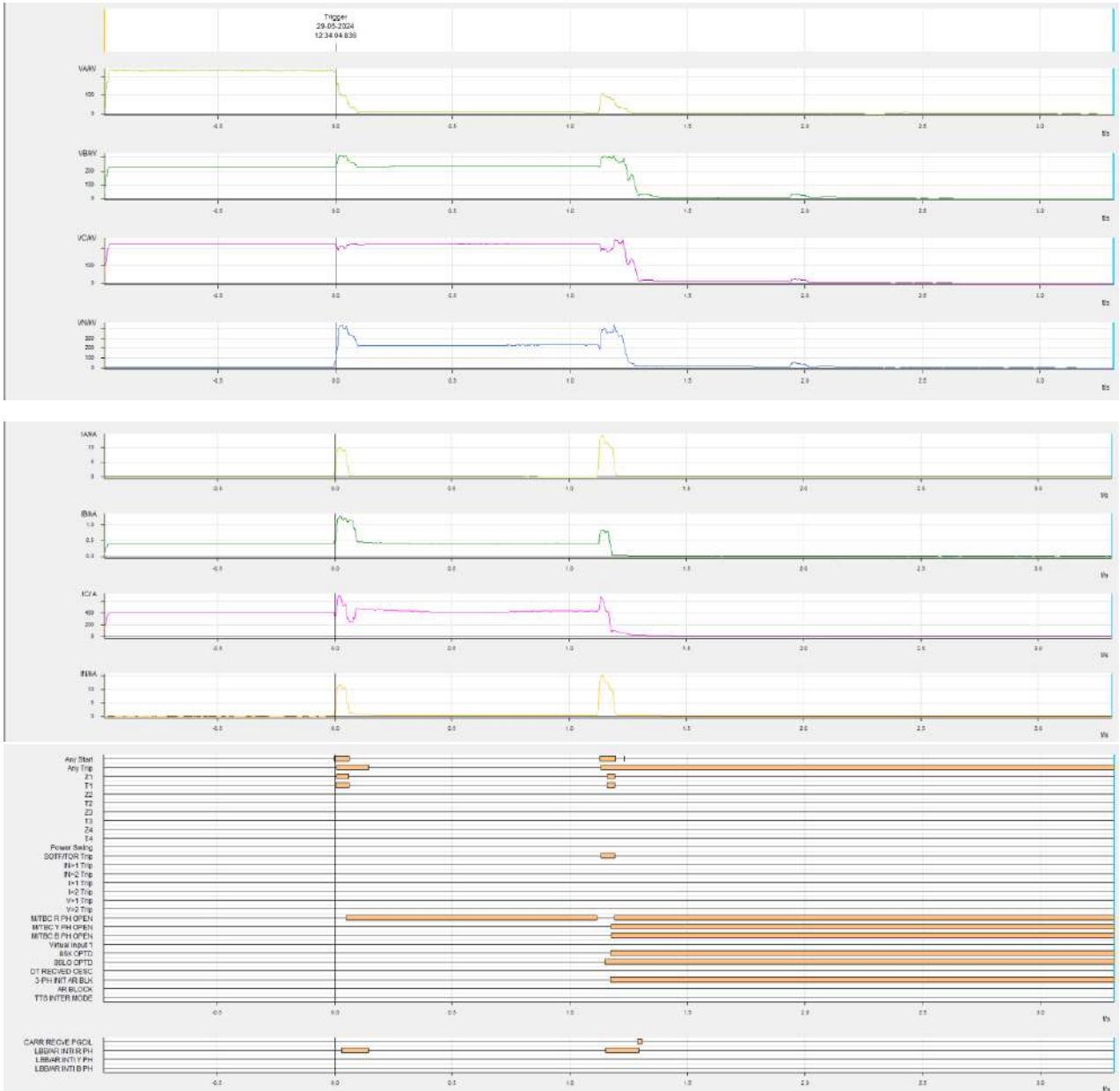
15. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

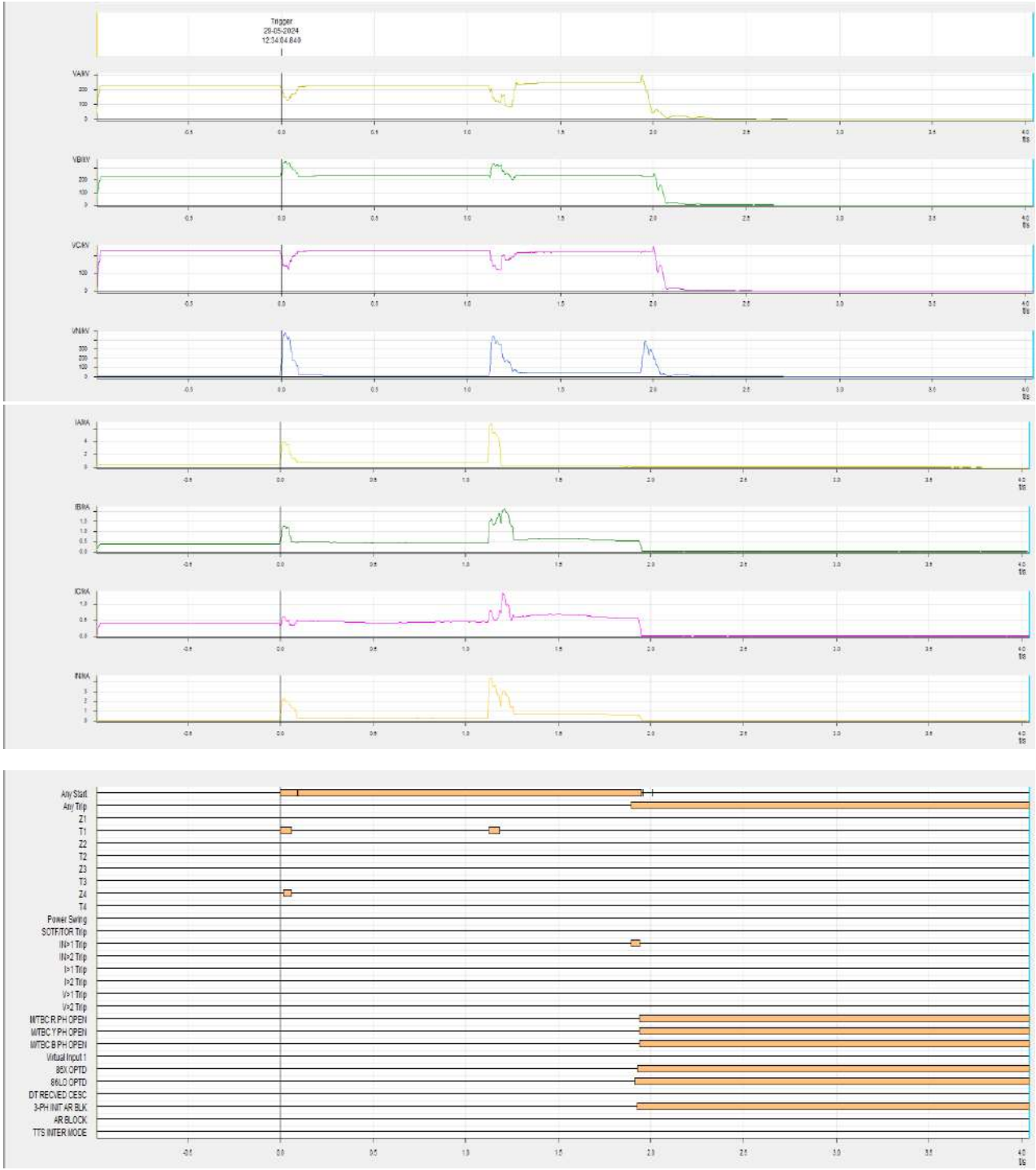
SoE data of Haldia Substation not available in ERLDC Scada.

Annexure 2:

DR of 400 kV Haldia-Subhahsgram-2 (Haldia)



DR of 400 kV Haldia-Subhashgram-1 (Haldia)




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GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
 (भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
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पूर्वी क्षेत्रीय भार प्रेषण केन्द्र / Eastern Regional Load Despatch Centre

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पूर्वी क्षेत्र के 400/220 केवी उप-केन्द्र में ग्रिड घटना पर विस्तृत रिपोर्ट / Detailed Report of grid event in 400/220 kV Tenughat of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))
 (आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):14-06-2024

1. Event Summary (घटना का सारांश):

At 12:57 Hrs on 29.05.2024, Tenughat-Govindpur ckt-I tripped on Y-B Fault and Tenughat-Govindpur ckt II tripped only from Tenughat end as 220KV-Tenughat – Biharsariff was already in tripped condition. This caused tripping of both the running units due to loss of evacuation path at Tenughat and resulted in a generation loss of about 333 MW.

2. Time and Date of the Event (घटना का समय और दिनांक): 12:57 hrs of 29.05.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): Jharkhand

5. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
				Jharkhand	Jharkhand
Pre-Event (घटना पूर्व)	49.94 Hz	25657 MW	28796MW	333 MW	1923 MW
Post Event (घटना के बाद)	49.94 Hz	25324 MW	28796 MW	0 MW	1923 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	220KV-Tenughat – Biharsariff was in tripped condition
Weather Condition (मौसम स्थिति)	Normal weather

6. Load and Generation loss (लोड और जनरेशन हानि): Generation loss: 333 MW; Load loss: NIL.

7. Duration of interruption (रूकावट की अवधि): 00:17 Hrs

8. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

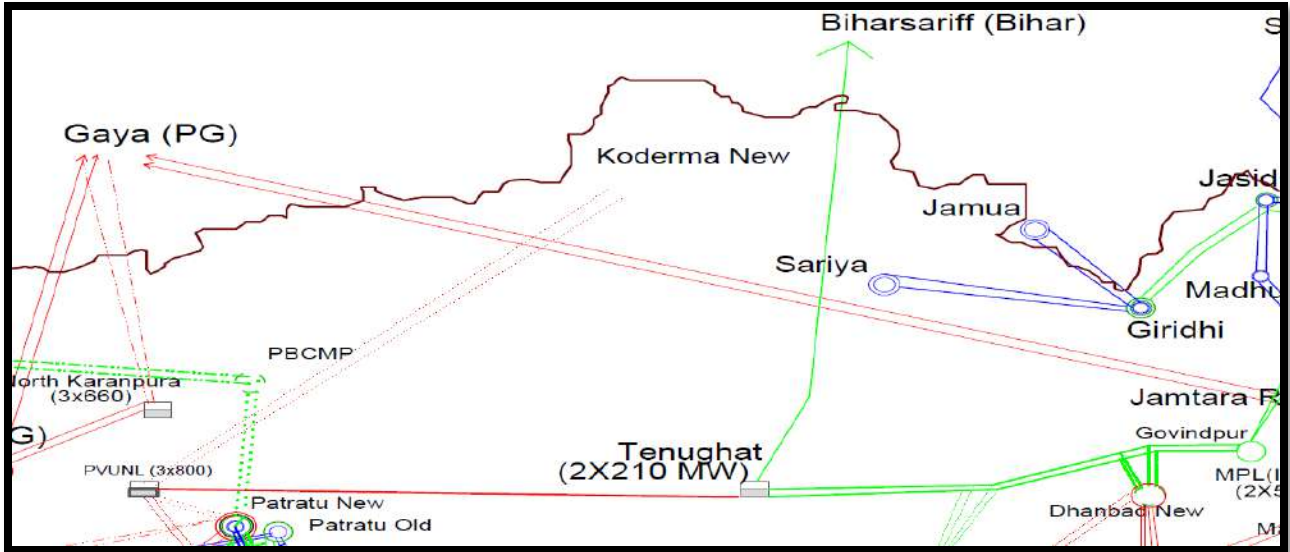


Figure 1: Network across the affected area

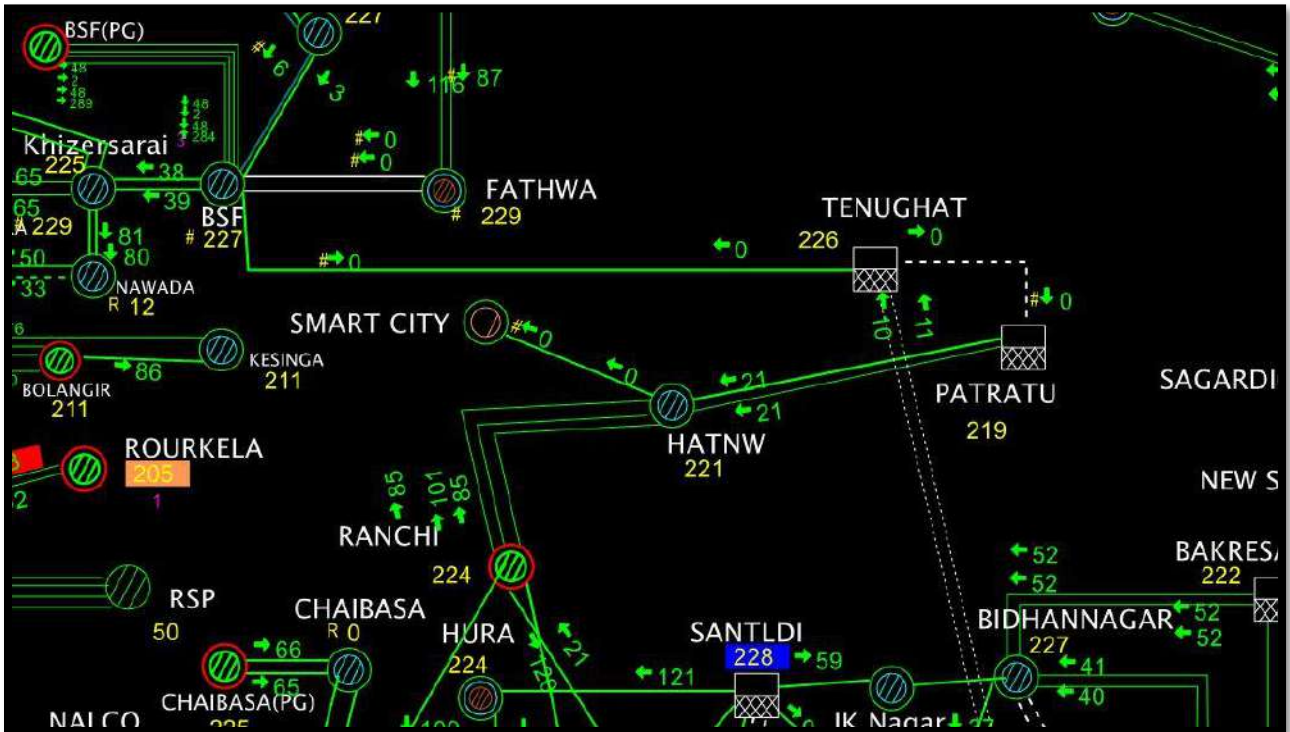


Figure 2: SCADA snapshot of the affected area

9. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): NA

10. Major Elements Tripped (प्रमुख ट्रिपिंग):

क्र०स०	नाम	Trip time (hh:mm:ss)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	220 kV Tenughat-Govindpur-1	12:57	Tenughat: O/C, E/F	Govindpur: R-Y, 62Km	13:25
2	220 kV Tenughat-Govindpur-2		Tenughat: Tripped from only Tenughat end		13:14
4	2*210 MW Units at Tenughat	12:57	Tenughat: Loss of evacuation path		U#1: 17:37 U#2: 21:54
5	220 kV Bus-1 & 2 at Tenughat		All emanating lines tripped		-Bus 1 & 2: 13:14

11. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- There was a high resistive fault in B phase of TTPS-Govindpur line 1 and line tripped at Tenught end sensing the fault but it did not trip at Govindpur end as current was very less due to high resistive fault.
- As soon as TTPS end breaker tripped, R&Y phase at Govindpur end was intact so feeding charging current while B phase started feeding the fault as there was high resistive fault in B phase, which is visible from DR phasor.

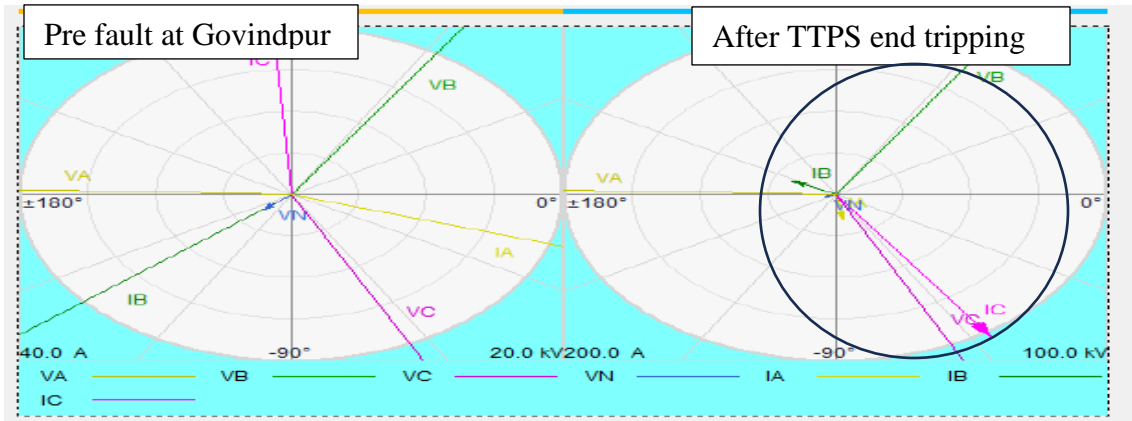


Figure 3: Current reversal in 220 kV Tenughat-Govindpur-1 at Govindpur

- B (C) phase at Govindpur became source after tripping from TTPS end for circuit -1 while in R&Y phase, there was charging current.
- Later when fault evolved and current increased, Govindpur sensed zone2 then zone-1 and tripped the line.

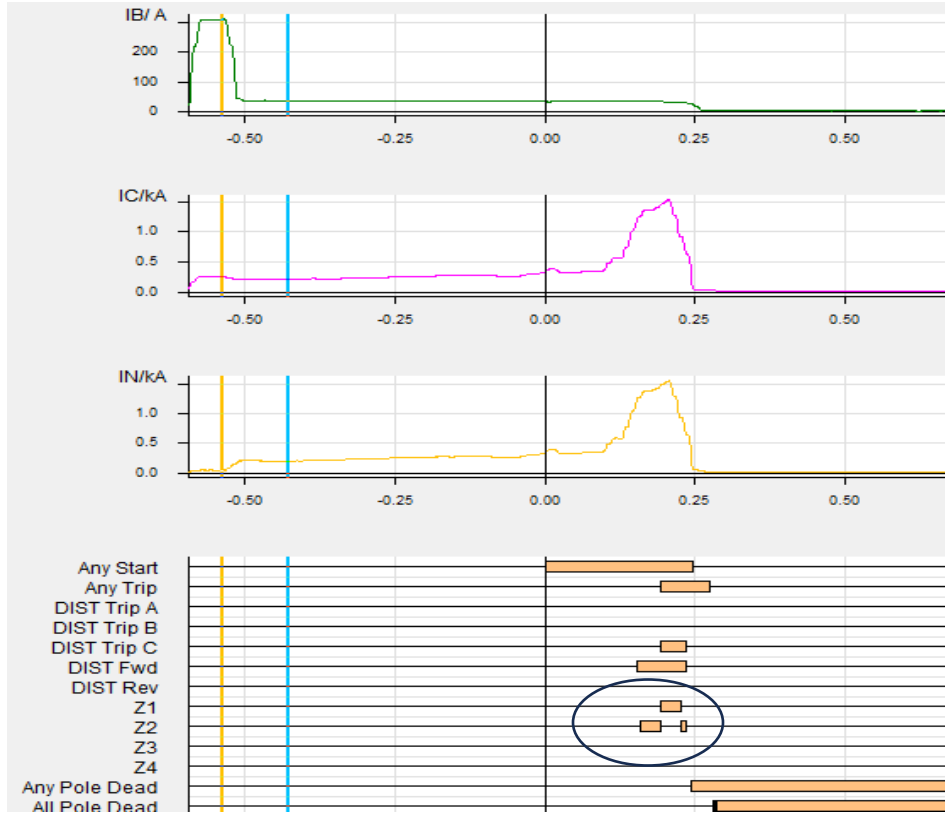


Figure 4: DR of 220 kV Tenughat-Govindpur-1 at Govindpur

- Seems auto reclose was not attempted at Govindpur end. Reason may be explained by JUSNL.
- At the same instance, as circuit 2 at TTPS end was also sensing the same resistive fault continuously, it also tripped on O/C/ E/f protection after 700ms leading to tripping of both circuits.

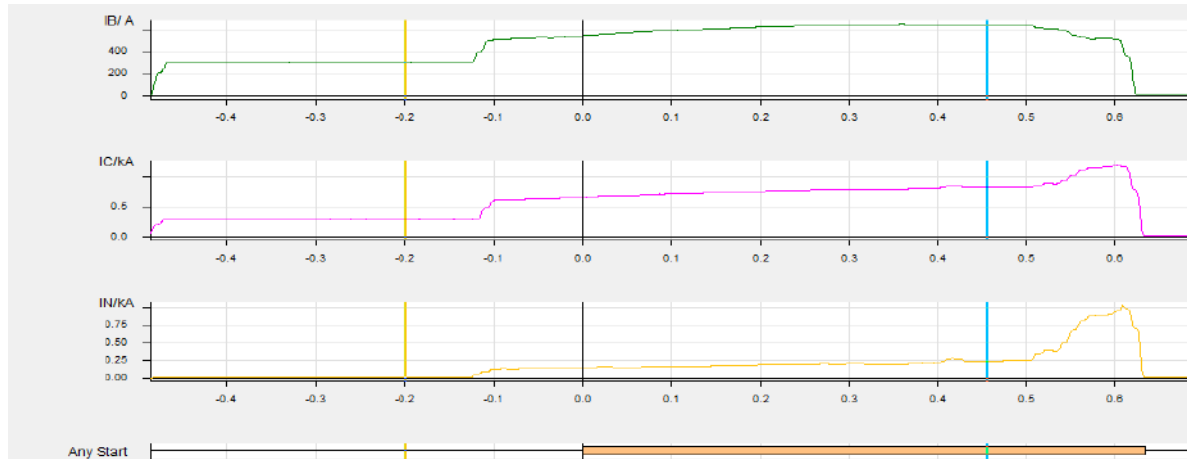


Figure 5: DR of 220 kV Tenughat-Govindpur-1 at Tenughat

- As Tenughat -Biharshariif line was already out and Tenughat-Govindpur D/C tripped, there was no evacuation path for Tenughat machines.
- So Tenughat machines got islanded with the load of PVUNL, which is taking start up power and machines tripped on over frequency.
- Over frequency can be seen in below PMU plot.

PMU Snapshot:

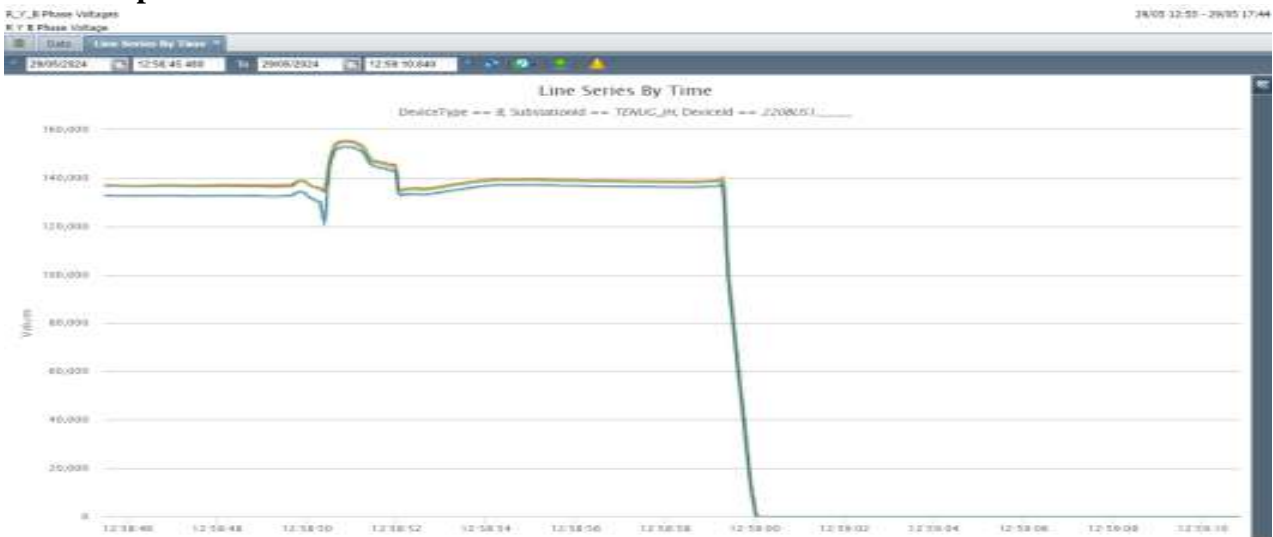


Figure 6: PMU Voltage snapshot of 400/220 kV Tenughat S/S

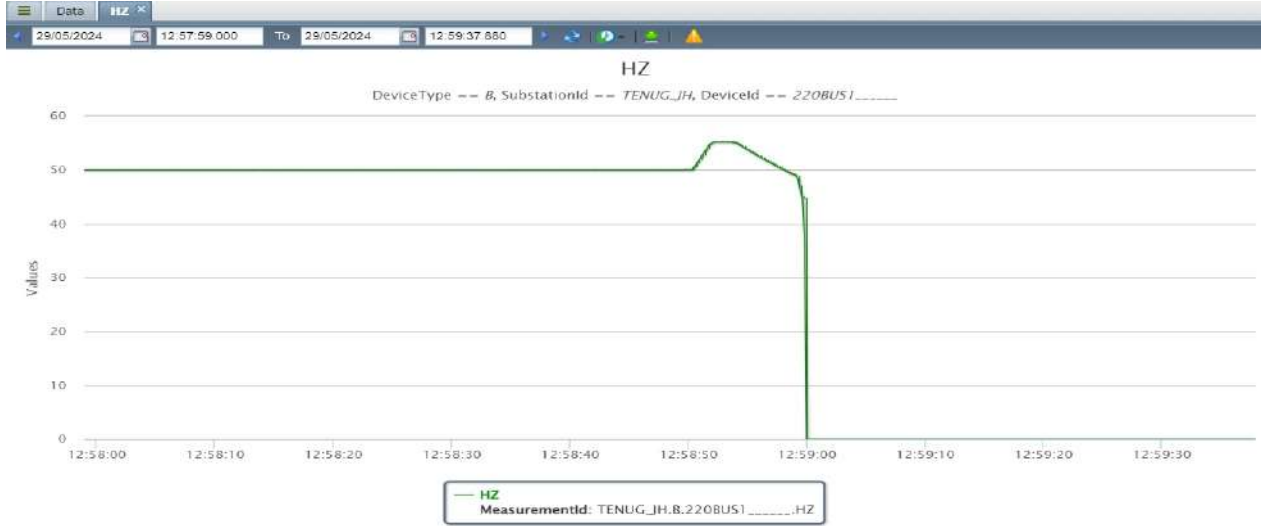


Figure 7: PMU Frequency snapshot of 400/220 kV Tenughat S/s

12. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- DEF and O/C E/F to be co-ordinated and operation time to be kept after zone-3 time. If at TTPS end TSM is changed in a manner it takes some more time for tripping which can prevent tripping of another circuit on O/C E/f or DEF.
- Auto recloser at Govindpur end to be checked.
- DR is not Time Synchronised.

13. Action Taken/Remedial Measures (सुधारात्मक उपाय):

- Setting for DEF & O/C E/F to be revised.

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

S.No.	Issues	Regulation Non-Compliance	Utilities
2.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	JUSNL

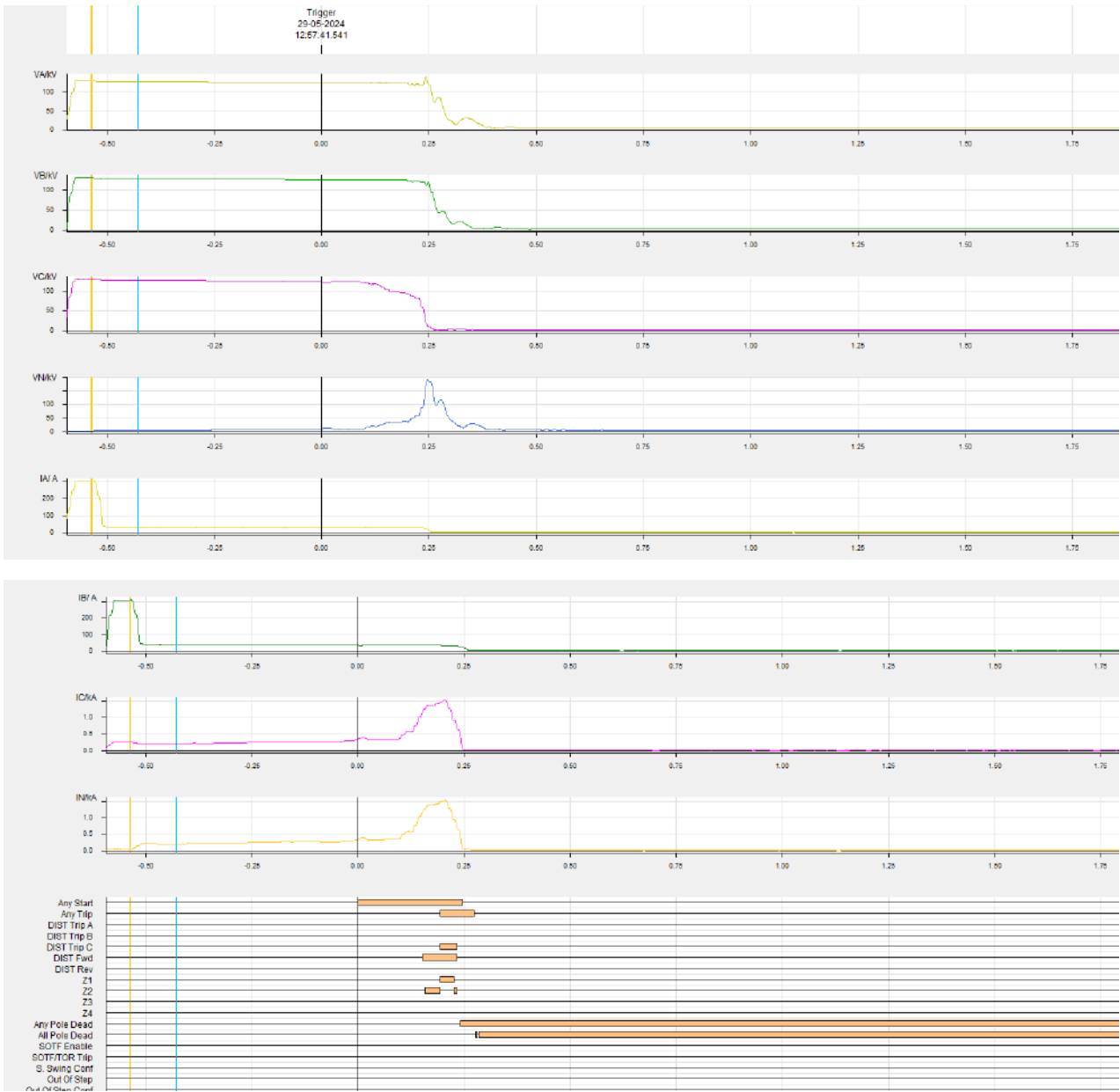
15. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

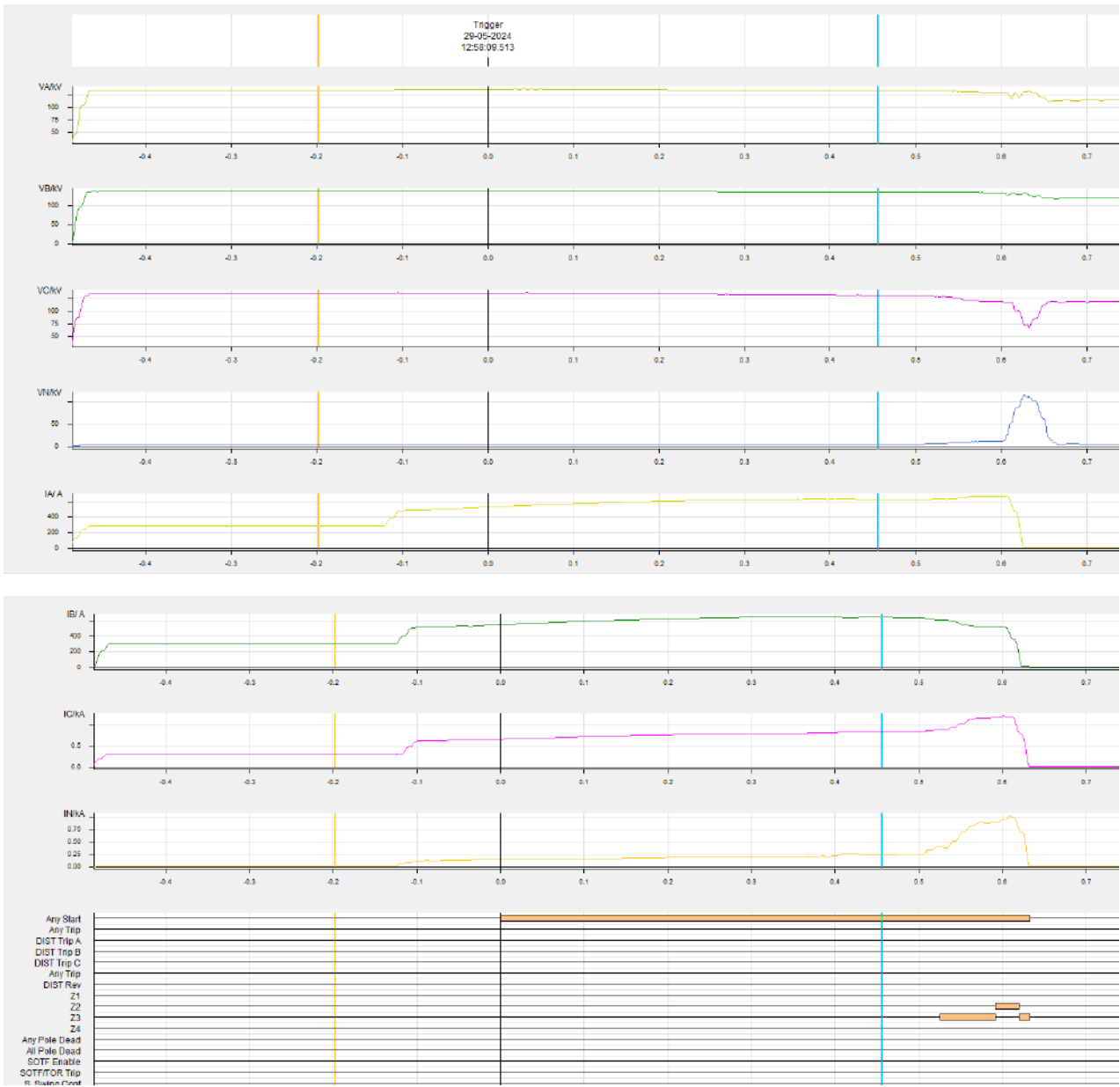
SOE data not available in ERLDC Scada.

Annexure 2:

DR of 220 kV Tenughat-Govindpur-1 (Govindpur)



DR of 220 kV Tenughat-Govindpur-2 (Tenughat)




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GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
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पूर्वी क्षेत्र के 220 केवी उप-केन्द्र में ग्रिड घटना पर विस्तृत रिपोर्ट / Detailed Report of grid event in 220 kV Chandiposh & Barkot of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))
 (आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):14-06-2024

1. Event Summary (घटना का सारांश):

At 18:09 Hrs due to puncture in 220 kV BPI of Rengali-Rengali(PH)-I, 220 kV Rengali- Chandiposh tripped along with 220 kV Rengali-Rengali(PG) D/C and 220 kV Rengali-Barkot, leading to total power failure in 220 kV Bus at Chandiposh and 220 kV Bus at Barkot Area. Approximate load loss of 30 MW at Chandiposh and 10 MW at 220 kV Barkot was reported. Total Load Loss was 40 MW.

2. Time and Date of the Event (घटना का समय और दिनांक): 18:19 hrs of 21.05.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): Odisha

5. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency (Hz)	Regional Generation (MW)	Regional Demand (MW)	State Generation	State Demand
				Odisha (MW)	Odisha (MW)
Pre-Event (घटना पूर्व)	50.07	28931	24949	2404	4911
Post Event (घटना के बाद)	50.07	28931	24909	2404	4871

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	220 kV Tarkera-Chandiposh and 220 kV Tarkera-Barkot were hand tripped due to overloading of 220 kV Bamra- Tarkera and 220 kV Kuarmunda- Tarkera
Weather Condition (मौसम स्थिति)	Rain and Wind conditions.

6. Load and Generation loss (लोड और जेनरेशन हानि): Generation loss: NIL; Load loss: 40 MW.

7. Duration of interruption (रूकावट की अवधि): 00:46 Hrs

8. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

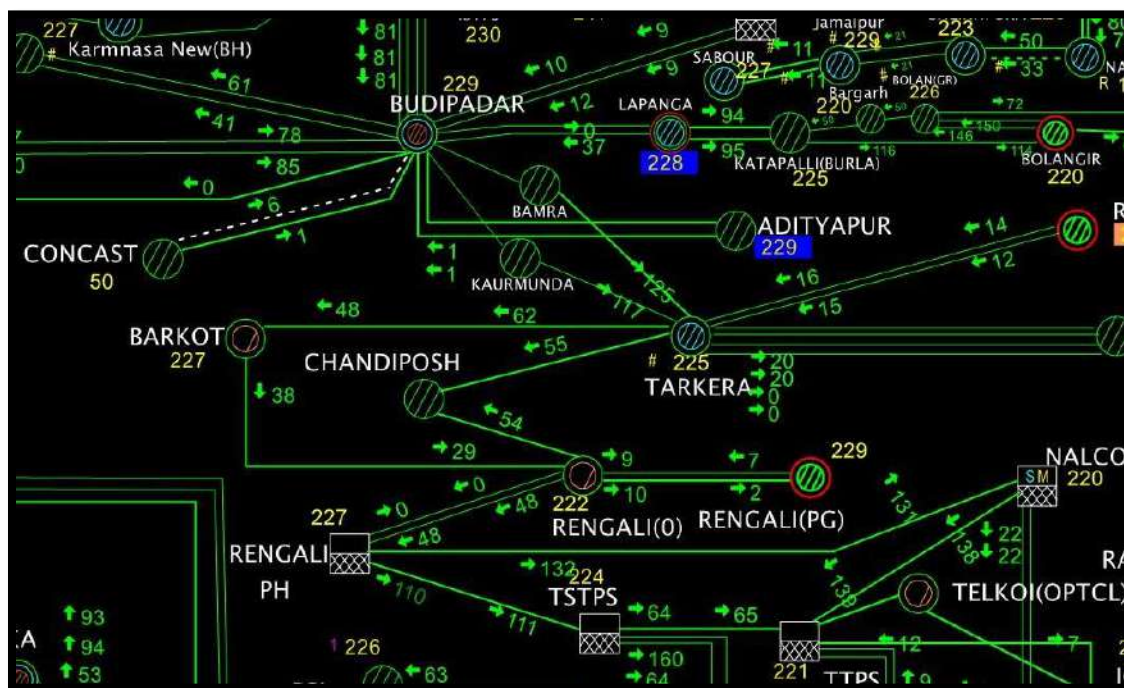


Figure 1: Network across the affected area

9. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): Y Phase BPI failure at Rengali OPTCL end for 220 Kv Rengali -Rengali(PH)-I

10. Major Elements Tripped (प्रमुख ट्रिपिंग)

क्र०सं०	नाम	Trip time (hh:mm:ss)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	220 kV Rengali-Rengali (PH)-I	18:19	Zone-4,		Restored later
2	220 kV Rengali-Rengali (PH)-II	18:19	Hand tripped later from OPTCL end		Restored later
3	220 kV Rengali-Rengali (PG) D/C	18:19		Tripped from PG end	19:42&19:43
4	220 kV Rengali -Barkot			Tripped from Barkot end	19:48
5	220 kV Rengali -Chandiposh	18:19	Tripped from Chnadiposh end.		19:05

11. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- There was failure of 220 kV Y phase BPI of Rengali-Rengali (PH)-I at OPTCL end and this has resulted into Bus fault at Rengali (OPTCL).
- Seems there is no Busbar operation so the Rengali PH -Rengali (OPTCL)-I tripped in zone-4 from OPTCL end after 250 Ms, while ckt -2 did not trip and so all other lines feeding the fault tripped from remote end in zone-3 and fault was isolated.
- Later ckt -2 of Rengali-Rengali(PH) was hand tripped from OPTCL end.

PMU Snapshot:



Figure 2: PMU Voltage snapshot of 220 kV Regali-Talcher-2

12. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- **Status of Busbar at Rengali (OPTCL)** may be explained by OPTCL.
- **Non-operation of zone-4 tripping at all other lines at Rengali (OPTCL)** may also be explained by OPTCL due to which fault was cleared after delay as all lines tripped from remote end in zone-2&3.

13. Action Taken/Remedial Measures (सुधारात्मक उपाय): To be shared by OPTCL.

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

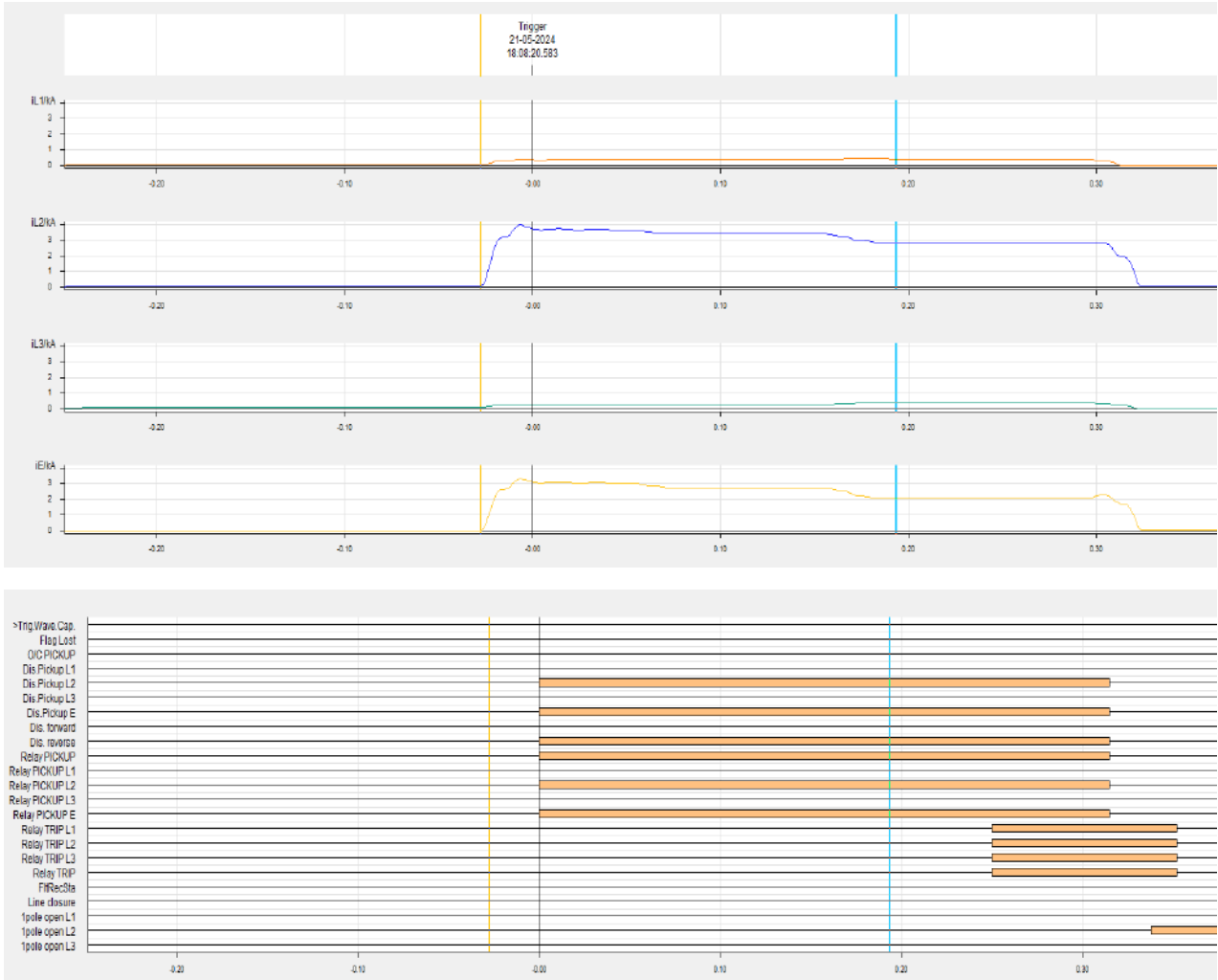
S.No.	Issues	Regulation Non-Compliance	Utilities
2.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	OPTCL

15. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

SOE data not available in ERLDC Scada.

Annexure 2: DR of of Rengali-Rengali(PH)-I at OPTCL




ग्रिड-इंडिया
GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
 (भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
 (A Government of India Enterprise)
 [formerly Power System Operation Corporation Limited (POSOCO)]

पूर्वी क्षेत्रीय भार प्रेषण केन्द्र / Eastern Regional Load Despatch Centre

कार्यालय : 14, गोल्फ क्लब रोड, टॉलिंगंज, कोलकाता - 700033
 Office : 14, Golf Club Road, Tollygunge, Kolkata - 700033
 CIN : U40105DL2009GOI188682, Website : www.erfdc.in, E-mail : erfdinfo@grid-india.in, Tel. : 033 23890060/0061

**पूर्वी क्षेत्र के 220/132 केवी गरौल उप-केन्द्र में ग्रिड घटना पर विस्तृत रिपोर्ट / Detailed Report of grid event
 at 220/132 kV Goraul S/s of Eastern Region
 (To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss
 Event as per IEGC section 37.2 (f))
 (आई ई जी सी 37.2 (एफ) के अनुपालन में)**

Date(दिनांक):14-06-2024

1. Event Summary (घटना का सारांश):

At 08:02 hrs on 09.05.2024, 220kV Muzaffarpur-Goraul-2 tripped due to R-N fault which led to total power failure at Goraul as 220kV Muzaffarpur-Goraul Ckt#1 was under breakdown. Total load loss of around 15 MW at Goraul was reported. Power was extended through 132kV system via Hazipur, Jandaha and Manhar link.

2. Time and Date of the Event (घटना का समय और दिनांक): 08:02 hrs of 09.05.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): Bihar

5. Report submitted by Utility on: Not submitted

6. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
				Bihar	Bihar
Pre-Event (घटना पूर्व)	50.10	24825	20809	340	3797
Post Event (घटना के बाद)	50.10	24825	20794	340	3782

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	220kV Muzaffarpur-Goraul Ckt#1 in outage condition since 11/06/2022 due to GIS bay CT Blast.
Weather Condition (मौसम स्थिति)	Rain and Wind conditions.

7. Load and Generation loss (लोड और जेनरेशन हानि): Generation loss: NIL; Load loss: 15 MW.

8. Duration of interruption (रूकावट की अवधि): 00:10 Hrs

9. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

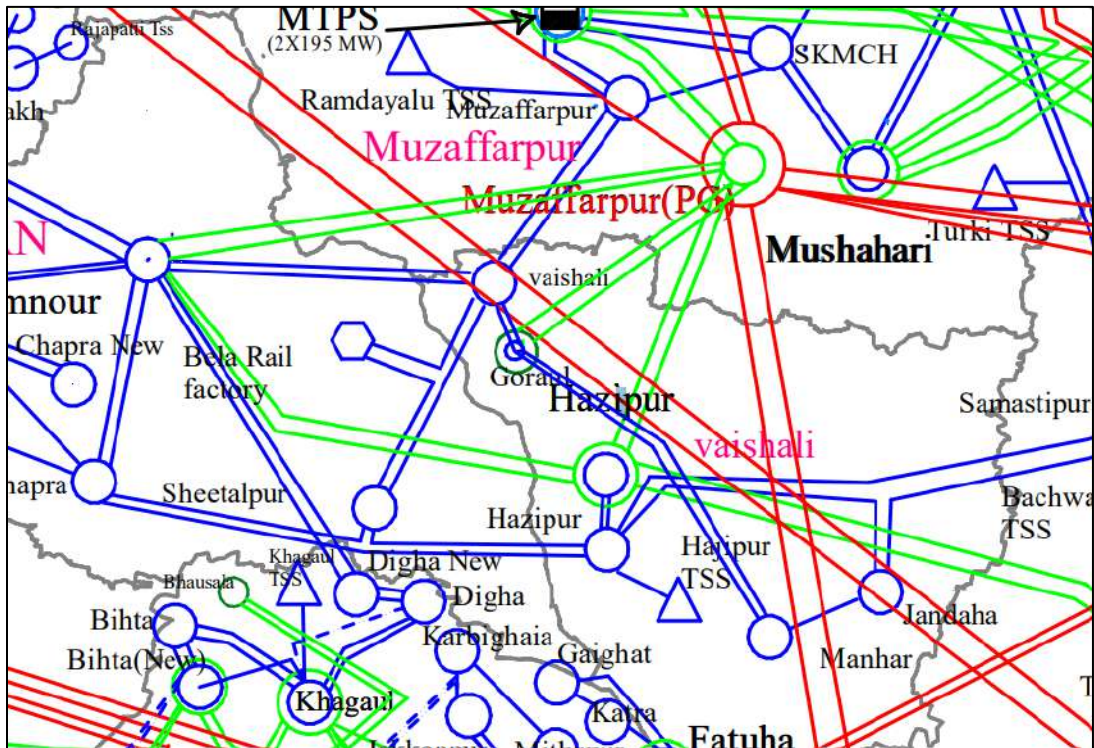
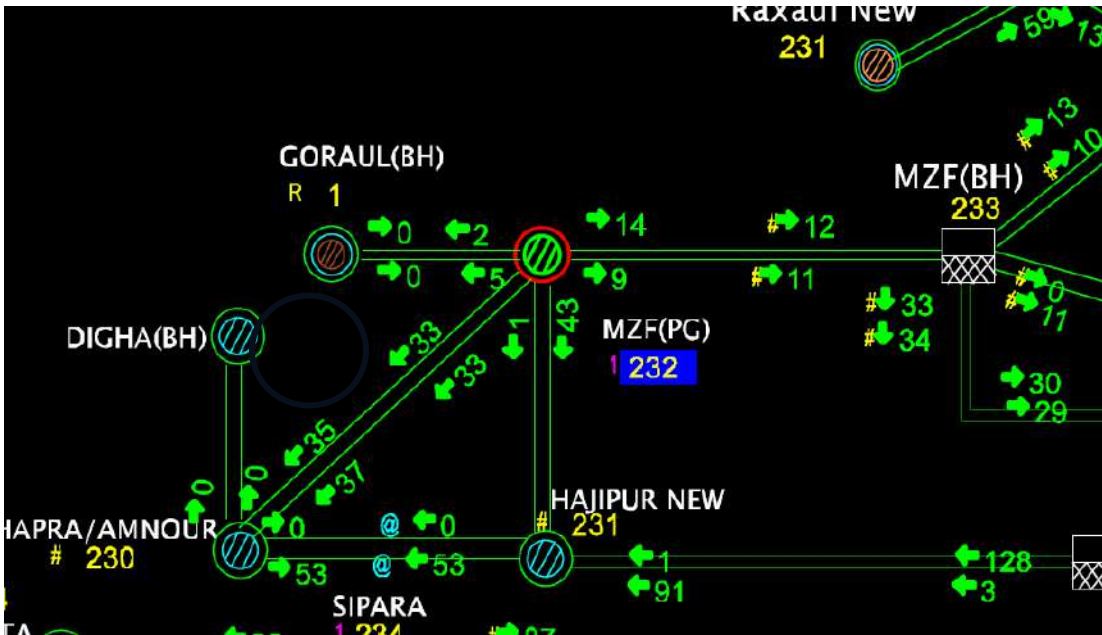


Figure 1: Network across the affected area

10. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): NA

11. Major Elements Tripped (प्रमुख ट्रिपिंग)

S.No. (क्र० सं०)	Transmission/Generation element name (संचरण लाइन / विद्युत उत्पादन इकाई का नाम)	Trip Time (बंद होने का समय)	Restoration time (वापस आने का समय)	Reason/ Relay Indication (कारण/रिले संकेत)
1	220kV Muzaffarpur-Goraul Ckt#2	08:02	11:02	R-N Fault, 10.5Km from Muzaffarpur end, F/C- 11.8KA
2	220kV Bus#1&2 at Goraul (BH)			Tripping of 220kV Muzaffarpur-Goraul#2

12. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- At 08:02 Hrs 220kV Goraul buses became dead as 220kV Muzaffarpur-Goraul Ckt#2 tripped due to R-N fault and 220kV Muzaffarpur-Goraul Ckt#1 was already under outage due to GIS Bay CT blast at Muzaffarpur. Heavy lightning and adverse weather reported around the area.
- Total load loss reported was around 15 MW in Goraul area.
- At 08:12 Hrs Power was extended through 132kV system via Hazipur, Jandaha and Manhar link.
- The charging attempt of Ckt#2 was delayed due to failure of closing command of breaker at Muzaffarpur (PG) end (bay owned and maintained by Bihar). Later, 220kV buses at Goraul charged through 220kV Muzaffarpur-Goraul Ckt#2 at 11:02hrs.

PMU Snapshot:

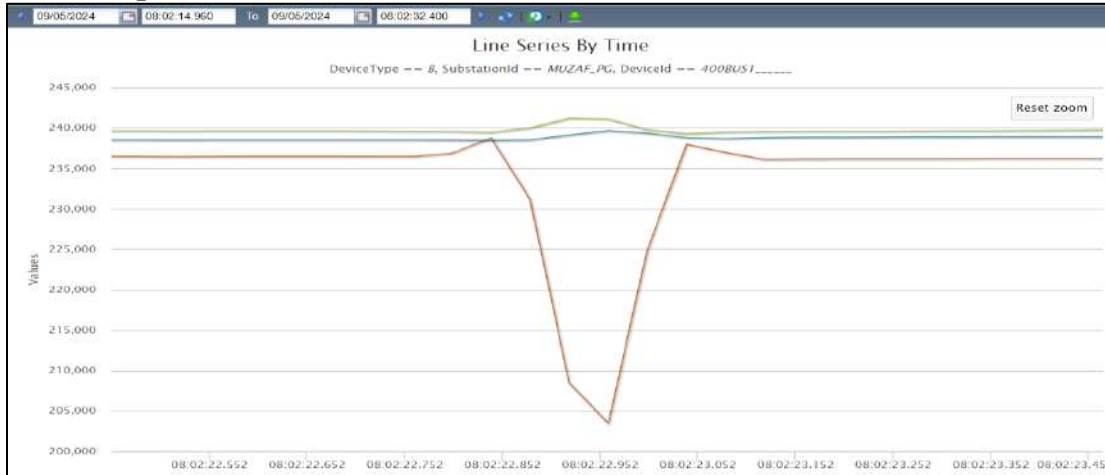


Figure 2: PMU Voltage snapshot of 400/220 kV New Purnea S/S

13. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- Charging attempt was delayed by 03 Hrs due to failure of closing command of breaker, issue with the breaker or control may be explained along with remedial measures.
BSPTCL to explain.
- Whether Auto reclose attempted or not could not be ascertained as DR/EL not submitted.
BSPTCL to explain?

14. Action Taken/Remedial Measures (सुधारात्मक उपाय): Nil

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

S.No.	Issues	Regulation Non-Compliance	Utilities
2.	Whether DR/EL provided within 24 Hours?	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	BSPTCL, PG ER-1 (No)

16. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

SoE data not available for the event.



ग्रिड-इंडिया
GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
(A Government of India Enterprise)
[formerly Power System Operation Corporation Limited (POSOCO)]




पूर्वी क्षेत्रीय भार प्रेषण केन्द्र / Eastern Regional Load Despatch Centre

कार्यालय : 14, गोल्फ क्लब रोड, टॉलिंगंज, कोलकाता - 700033
Office : 14, Golf Club Road, Tollygunge, Kolkata - 700033
CIN : U40105DL2009GOI188682, Website : www.erldc.in, E-mail : erldcinfo@grid-india.in, Tel. : 033 23890060/0061

पूर्वी क्षेत्र के 400/220 केवी उप-केन्द्र में ग्रिड घटना पर विस्तृत रिपोर्ट / Detailed Report of grid event in 220/ 132 kV Dalkhola of Eastern Region

(To be submitted by RLDC/NLDC during Grid Disturbances/Grid Incidents/Near Miss Event as per IEGC section 37.2 (f))

(आई ई जी सी 37.2 (एफ) के अनुपालन में)

Date(दिनांक):14-06-2024

1. Event Summary (घटना का सारांश):

At 02:42 Hrs on 31.05.2024, 132 kV Bus PT burst at Dalkhola(WB) and 132 kV Bus became dead. 220 kV Dalkhola(PG)-Kishanganj D/c also tripped from Kishanganj in Zone-3. Consequently, 220 kV Dalkhola (WB) S/s became dead. Load loss of 4 MW occurred at Dalkhola as other areas remained on alternate sources. All load was restored within 10 minutes.

2. Time and Date of the Event (घटना का समय और दिनांक): 02:42 hrs of 31.05.2024

3. Event Category (ग्रिड घटना का प्रकार): Grid Disturbance (GD)-1

4. Location/Control Area (स्थान/नियंत्रण क्षेत्र): West Bengal

5. Report submitted by Utility on: 13.06.2024

6. Antecedent Conditions (पूर्ववर्ती स्थिति):

	Frequency	Regional Generation	Regional Demand	State Generation	State Demand
				West Bengal	West Bengal
Pre-Event (घटना पूर्व)	49.99 Hz	28426 MW	22896MW	4813 MW	7319 MW
Post Event (घटना के बाद)	49.99 Hz	28426 MW	22892MW	4813 MW	7315 MW

**Pre and post data of 1 minute before and after the event*

Important Transmission Line/Unit if under outage (महत्वपूर्ण संचरण लाइने/ विद्युत उत्पादन इकाइयां जो बंद हैं)	220 kV Bus Coupler at Dalkhola(PG) was under open condition.
Weather Condition (मौसम स्थिति)	Normal weather

7. Load and Generation loss (लोड और जेनरेशन हानि): Generation loss: NIL; Load loss: 4 MW.

8. Duration of interruption (रूकावट की अवधि): 00:10 Hrs

9. Network across the affected area (प्रभावित क्षेत्र का नक्शा)

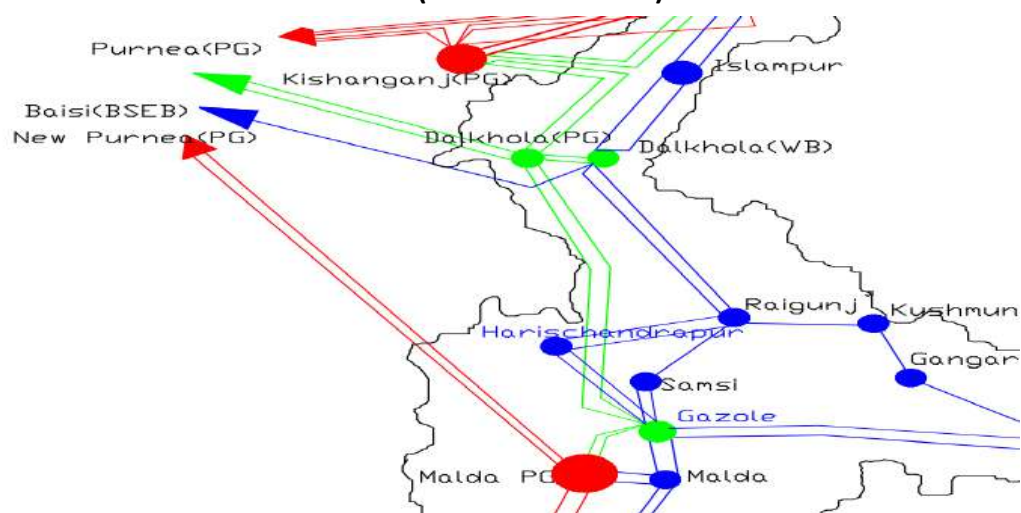


Figure 1: Network across the affected area

10. Details of Equipment Failure (if any during the event) (उपकरण विफलता का विवरण): 132 kV Bus PT at Dalkhola (WB) burst

11. Major Elements Tripped (प्रमुख ट्रिपिंग)

क्र०स०	नाम	Trip time (hh:mm:ss)	उप केंद्र 1 रिले संकेत	उप केंद्र 2 रिले संकेत	Restoration time
1	132 kV Dalkhola-Islampur-2	02:42:53	Dalkhola: R_Y_B, 8.89 km, Ir: 8.667 kA, Iy: 7.924 kA, Ib:7.732 kA	Islampur: R_Y_B, Zone-2, 58.294 km	04:41
2	132 kV Dalkhola-Raiganj D/c	02:42:54	Dalkhola: Y_B_N, Zone-1, 1.71 kA (Ckt-1); Y_B_N, Zone-1, 1.15 kA (CKT-2)	-	03:55
3	132 kV Dalkhola-Islampur-1		Islampur: Y_B, Zone-1	-	04:41
4	220 kV Dalkhola-Kishanganj D/c		Y_B_N, Zone-3	-	03:55

6	220 kV Dalkhola-Dalkhola D/c	04:12/04:11	Handtripped for restoration	04:32/09:07
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12. Event Analysis (Based on PMU, SCADA & DR) (घटना का विश्लेषण):

- A three phase fault struck 132 kV Dalkhola-Islampur-2 in close vicinity of Dalkhola. This line tripped in Zone-1 at Dalkhola and in Zone-2 time from Islampur after 450 msec.
- It is suspected that this led to failure of 132 kV R_ph bus PT at Dalkhola.
- 132/33 kV 20 MVA transformer tripped on REF.
- After around 350 msec, another phase-to-phase fault developed at Dalkhola (WB) which persisted for around 900 msec. 132 kV Bus Bar protection didn't operate as it was under commissioning stage.
- 132 kV Dalkhola-Islampur-1, 132 kV Dalkhola-Raiganj D/c tripped in Zone-1 instead of Zone-4.
- The fault was finally cleared when 220 kV Kishanganj-Dalkhola (PG) tripped from Kishanganj end in Zone-3.
- Report from WBSETCL is attached at Annexure-3.

PMU Snapshot:

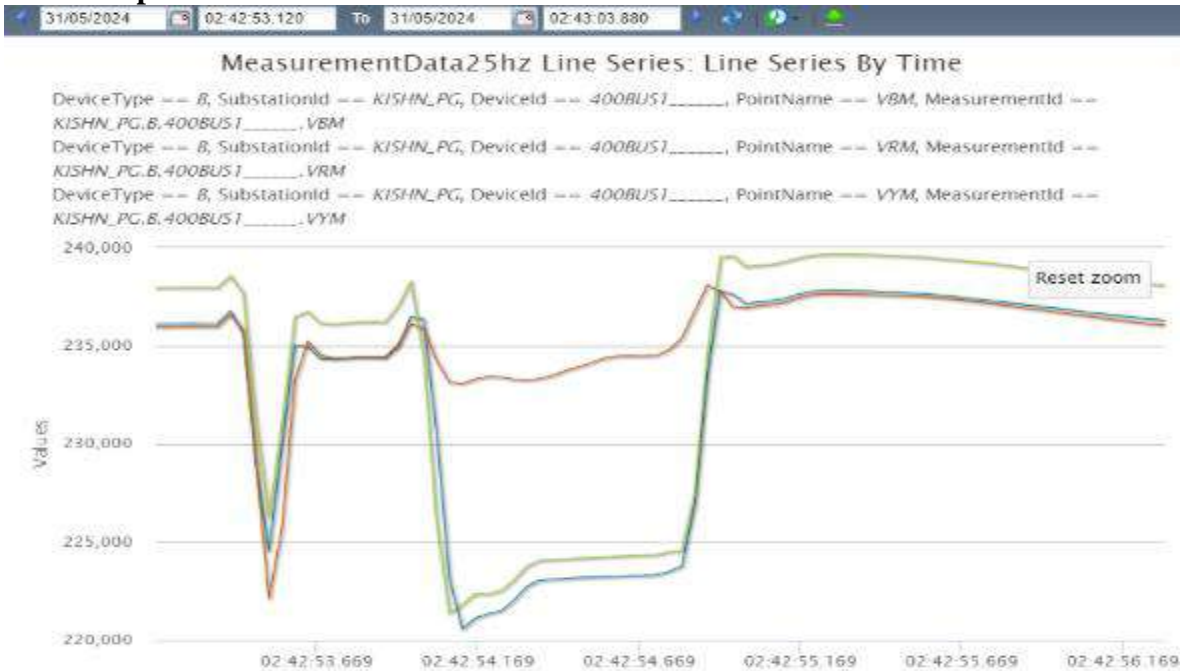


Figure 2: PMU Voltage snapshot of 400 kV Kishanganj S/S

13. Protection/Operational issues observed (सुरक्षा/परिचालन संबंधी समस्या):

- Zone-3 of 220 kV Dalkhola-Kishanganj D/c is encroaching next voltage level at Dalkhola.
- REF should not operate for bus fault in transformers. REF stability test may be done.

14. Action Taken/Remedial Measures (सुधारात्मक उपाय):

- Zone-3 time delay of 220 kV Dalkhola-Kishanganj-3 may be increased at Kishanganj.
- As reported relay setting of HV side of 220/132 kV transformers at Dalkhola has been revised so that bus fault can be within 800 msec.
- Bus bar protection has been commissioned on 11.06.2024.

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

S.No.	Issues	Regulation Non-Compliance	Utilities
2.	DR/EL not provided within 24 Hours	1. IEGC section 37.2 (c) 2. CEA grid Standard 15.3	WBSETCL, PG ER-1

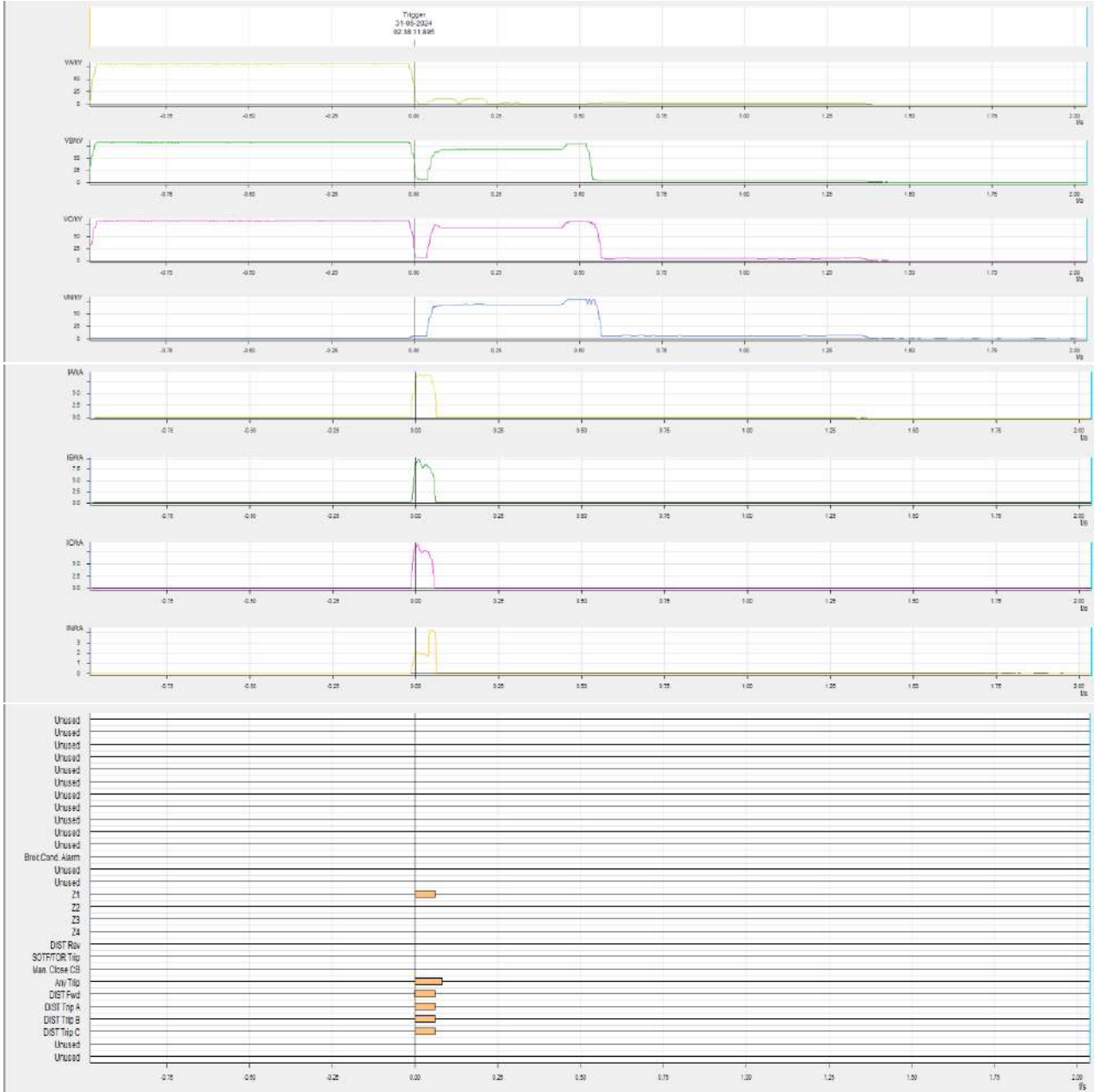
16. Key Lessons Learnt (प्रमुख अधिगम बिंदु): Nil

Annexure 1: (Sequence of Events-As per ERLDC SCADA)

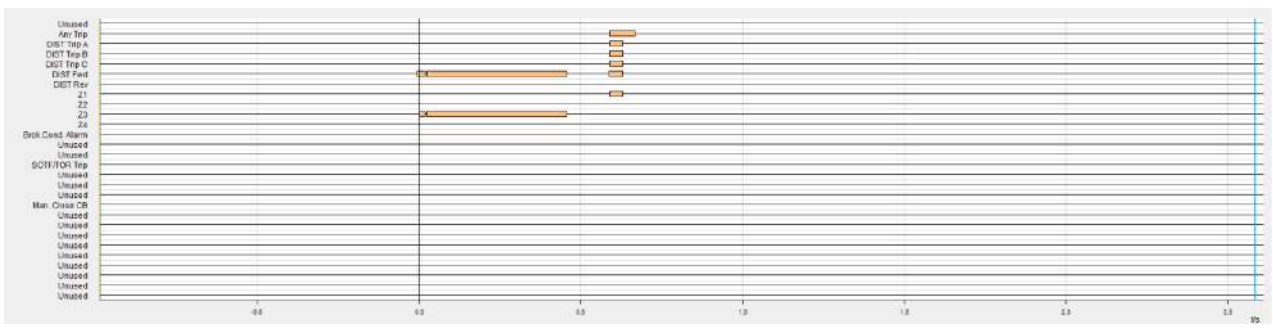
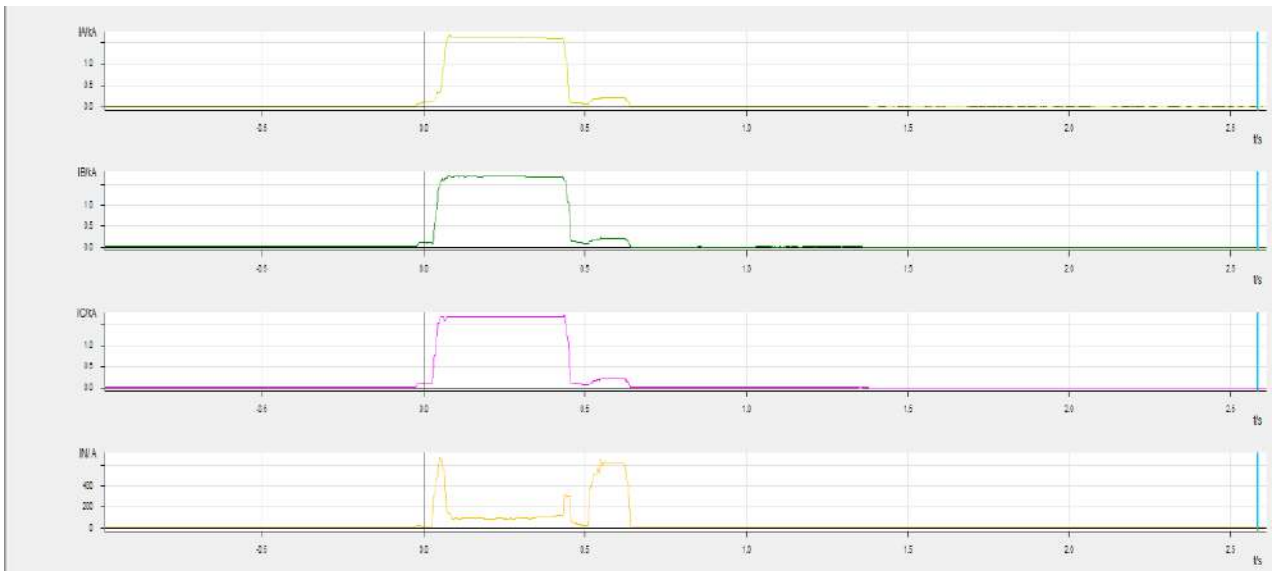
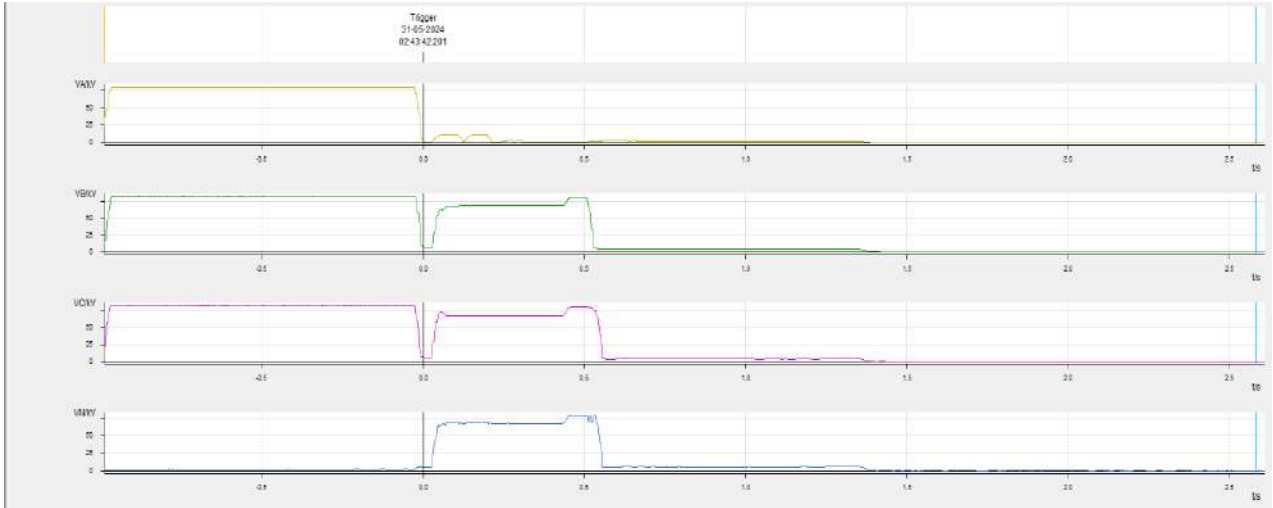
SOE data of Dalkhola Substation not available in ERLDC Scada.

Annexure 2:

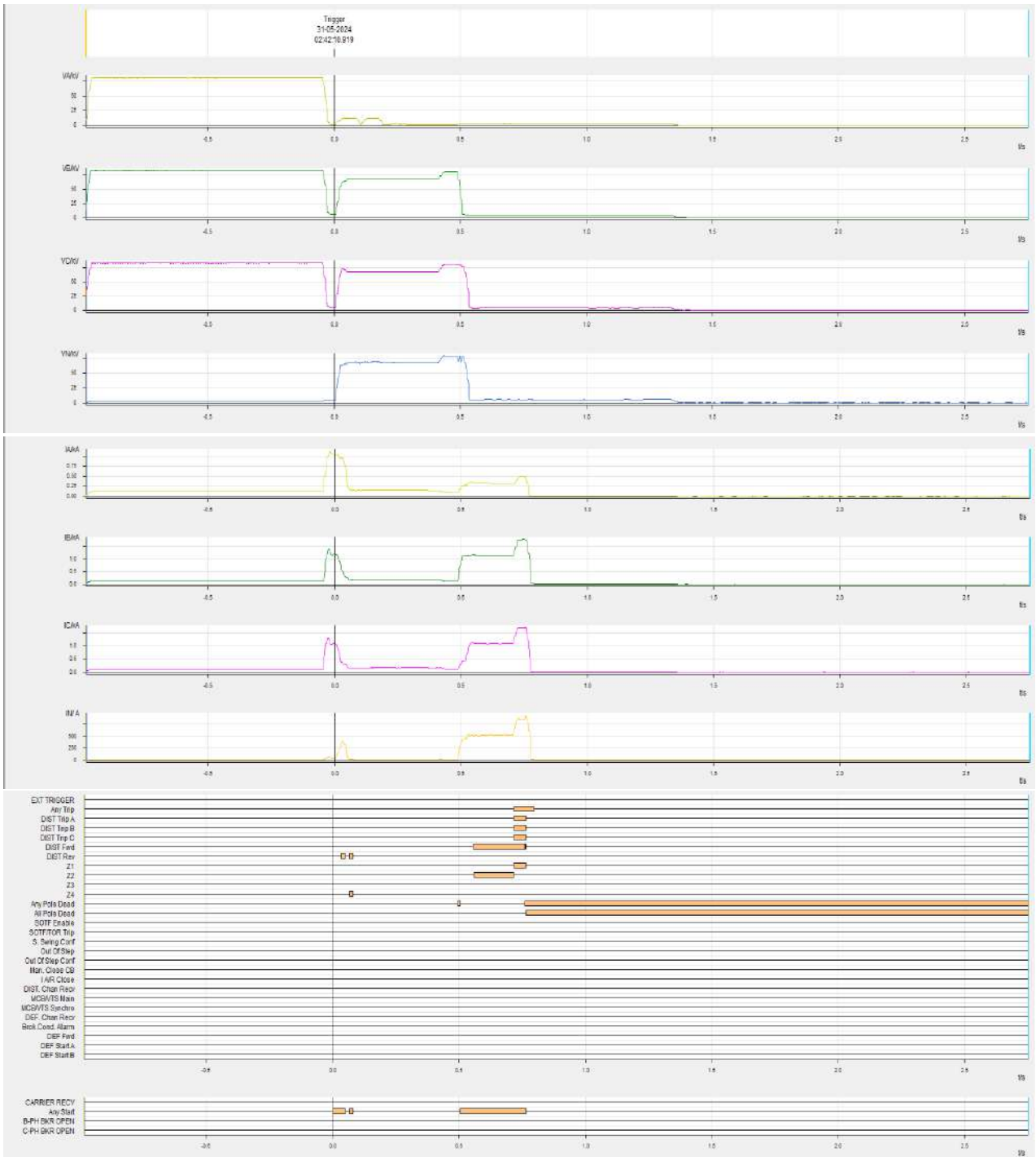
DR of 132 kV Dalkhola-Islampur-2 (Dalkhola)



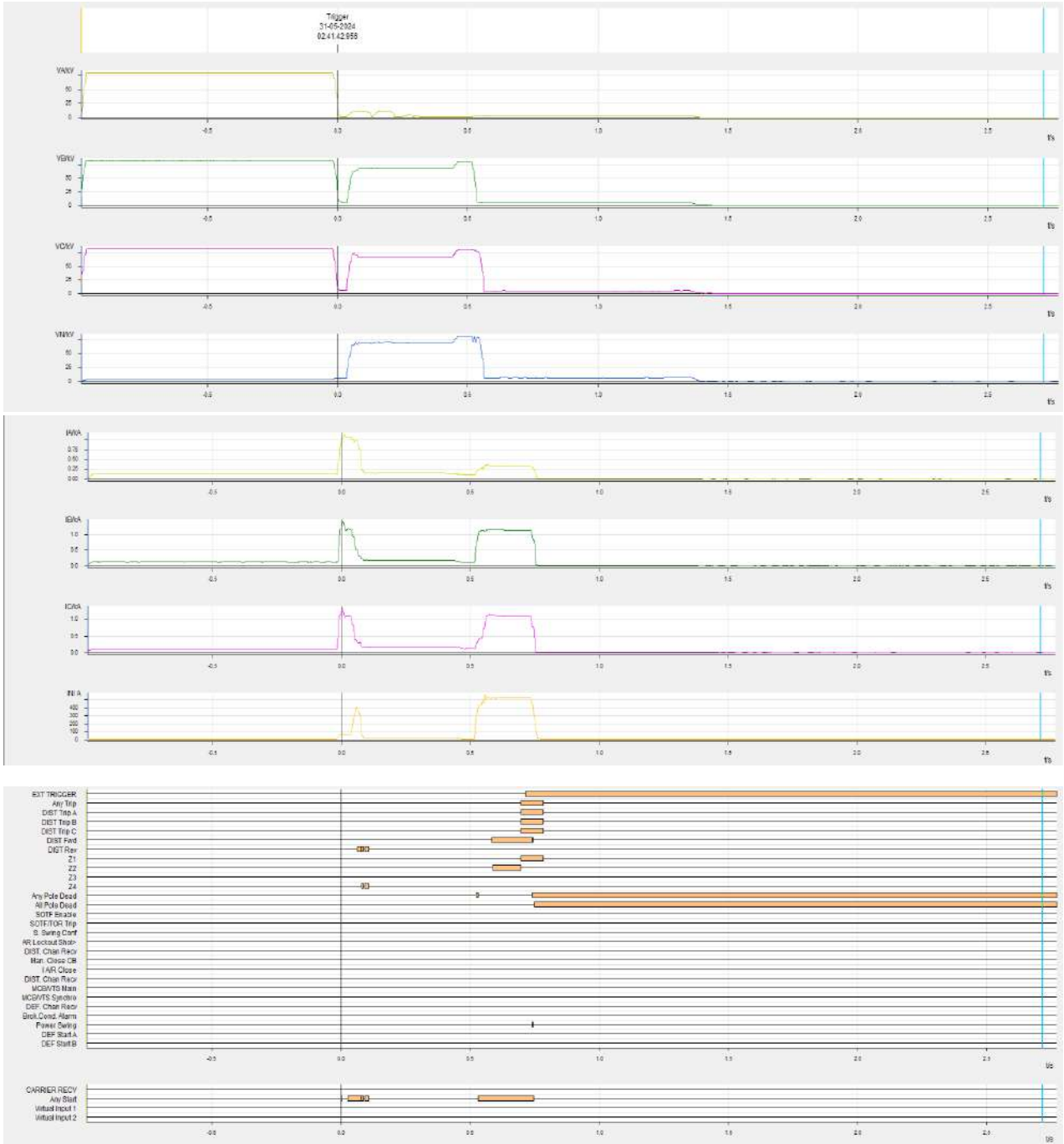
DR of 132 kV Dalkhola-Islampur-1 (Dalkhola)



DR of 132 kV Dalkhola-Raiganj-1 (Dalkhola)



DR of 132 kV Dalkhola-Raiganj-2 (Dalkhola)



**FORMAT FOR REPORTING SYSTEM DISTURBANCES
(Detailed Report)**

OCCURRENCE REPORT

(1) Date & Time of Occurrence

31-05-2024 & 02:45 Hrs

(2) Name of the Sub Station / Generating Station

Dalkhola 220 kV Sub-station

(3) Details of Occurrence

During severe thunderstorm, heavy rain and lightening, the 132kV 'R' Phase PT burst out at 02:45 Hrs on 31.05.2024 and total power failure occurred at 132kV Bus with tripping of the following feeders,

- (i) 132kV Raiganj D/C tripped at Dalkhola S/S end
- (ii) 132Kv Islampur D/C tripped at Dalkhola S/S end
- (iii) 220kV Dalkhola – Dalkhola PGCIL D/C did not trip but Dalkhola PGCIL-Kishanganj PGCIL ckt tripped at Kishanganj PGCIL S/S end.

(At Dalkhola PGCIL 220KV S/S :- 220kV Kishanganj D/C & 220KV Dalkhola (WBSETCL) D/C was connected to Bus-1 & 220kV B/C was open during the fault)

At the time of occurrence the disposition of feeders was as below

- 220 KV System :** 1) 220 KV Dalkhola PG D/C
- 2) 160 MVA TR #1 &2
- 132 KV System :** 1) Raiganj 132 KV D/C
- 2) Islampur 132 KC D/C
- 3) Baisi 132 KV Feeder
- 4) 132 KV Traction feeder
- 5) 31.5 MVA 132/33 KV TR 1&3
- 6) 20 MVA 132/33 KV TR #2

BUS Configuration : One Main and one Transfer for both 220 KV and 132 KV system.

For one and half breaker scheme

	Feeder I	Feeder II	Tie-breaker(On/Off)
Diameter 1			
Diameter 2			
Diameter 3			

(4) Sequence of Trippings

<p>Time: (hh mm ss) Event: .</p>

Generation Loss

Load Loss :-

(5) Relay Indication for Faulted Line/Transformer/Bus

Sl No	Name of Bay/Line	Local End Relay Type/Make And Indications	Relay Indication
			Remote End Relay Type/Make And Indications
1	Raiganj ckt-1	Dist Trip Z1	No
2	Raiganj ckt-2	Dist Trip Z1	No
3	Islampur Ckt-1	Dist Trip Z1	No
4	Islampur Ckt-2	Trip Z1, Fault location = 8.89 km Ia = 8.667 kA, Ib = 7.924 kA, Ic = 7.732 kA	Zone-2, Dist – 58.294 km

(9) Restoration

Sl No		From	To
1.	132KV RAIGANJ D/C	02:45 hrs	03:55 hrs
2	132KV TRACTION	02:45 hrs	04:02 hrs
3	132kV Baisi	02:45 hrs	04:16 hrs
4	220kV PG Ckt-1	02:45 hrs	04:32 hrs
5	132kV Islampur D/C	02:45 hrs	04:41 hrs
6	220kV PG Ckt-2	02:45 hrs	09:07 hrs

Remarks:

- After studying of Disturbance report, it has been understood that, initially a very close in 3 phase fault had occurred in line 132kV Dalkhola – Islampur Ckt-2 and the ckt got tripped at Dalkhola S/S end with Zone1 in approx. 60ms from the fault inception.
- It has been observed from the DR that the R phase voltage was not re-developed after clearance of above fault from Dalkhola S/S end due to burst out of 132 KV R phase PT.
- After approx. 500 ms from the initial fault, double phase to ground fault in Y & B ph. had started which might be due to bursting out of R ph PT and fire hazard happened thereafter and turned out to be a bus fault .
- Since, the tripping circuits of 132 KV Busbar Relay was not connected to the respective bays, tripping could not take place from Busbar relay.(Commissioning stage).
- Raiganj D/C and Islampur ckt 1 got tripped at Dalkhola end in Z1 instead of Z4 might be due to absence of R ph PT secondary voltages because fault in the PT itself.
- Eventually, the Bus fault was cleared after approx. 850 ms from the initiation of bus fault by tripping 220kV Dalkhola (PG) - Kishanganj (PG) D/C Line at Kishanganj S/S end (in Z3 distance as information received)

Remedial Measures/Lessons Learnt:-

- A new Numerical busbar was in commissioning stage in Dalkhola 132 KV system. All bay CT's were connected and tripping ckt to 132 KV bays were isolated to check busbar stability for outzone fault. However, 132 KV busbar relay tripping circuit made connected to all corresponding 132 KV bays on 11.06.2024.
- Relay setting at 160 MVA transformer HV side was reviewed and revised the settings. 456A/NI/Directional forward/0.2 so that bus fault on 132 KV side can be cleared within 800 ms.

Protection Performance Indices for the month of MAY'24 (In compliance of Clause 15(6) of IEGC 2023)																		
Sl. No.	Name of the element	Tripping Date	Tripping Time	Restoration Date	Restoration Time	Reason (Relay indication)		Nc		Nu		Nf		Dependability index (Nc/(Nc+Nf))	Security Index (Nc/(Nc+Nu))	Reliability Index (Nc/(Nc+Nu+Nf))	Remarks (Reason for performance indices less than 1)	Analysis of the event
						End A	End B	End A	End B	End A	End B	End A	End B					
1	Kharagpur-Midnapore #2	06.05.24	19:35:00	06.05.24	21:16:00	y-phase, Zone-1, A/r optd., A/R L/O		1		0		0		1	1	1		
2	Kharagpur-KTPP #2	06.05.24	19:43:00	06.05.24	20:06:00	B-phase, Zone-1, A/r optd., A/R L/O		1		0		0		1	1	1		
3	New Chhanditala-KTPP #1	06.05.24	20:02:00	06.05.24	20:37:00	B-phase, Zone-1, A/r optd., A/R L/O		1		0		0		1	1	1		
4	Newtown AA3-Baruipur #1	06.05.24	20:06:00	06.05.24	22:33:00	B-phase, Zone-1, A/r optd., A/R L/O	C-phase, Zone-1, A/R L/O	1	1	0	0	0	0	1	1	1		
5	Kharagpur-KTPP #2	06.05.24	20:15:00	06.05.24	20:31:00	B-phase, Zone-2, DT Rec., A/R L/O		1		0		0		1	1	1		
6	Arambag-KTPP #1	06.05.24	20:15:00	06.05.24	20:36:00	B-phase, Zone-1, A/r optd., A/R L/O		1		0		0		1	1	1		
7	Barasat-Rajarhat PG #2	06.05.24	20:29:00	06.05.24		R-phase, Zone-1, A/r optd., A/R L/O		1		0		0		1	1	1		

8	Arambag- NewPPSP#1	07.05.24	20:27:00	07.05.24	20:44:00	B-phase, Zone-1, A/r optd., A/R L/O		1		0		0		1	1	1	
9	Arambag- BKTPP #1	07.05.24	22:10:00	07.05.24	22:19:00	R-phase, Zone-1, A/r in prg., A/R L/O		0		0		1		#	0	#	A/R initiation not re- setted in faulty phase(R- phase)
10	Barasat- Rajarhat PG #1	08.05.24	19:06:00	08.05.24	20:57:00	3-phase trip , Gas Zone tripping		0		1		0		0	#	#	Gas zone L/O optd.of Busduct due to water ingress
11	Newtown AA3- Baruipur #1	11.05.24	10:56:00	11.05.24	11:02:00	R-phase, Zone-1, A/r optd., A/R L/O	R- phase, Zone-1, A/R L/O	1	1	0	0	0	0	1	1	1	
12	Newtown AA3- Baruipur #1	11.05.24	13:59:00	11.05.24	14:21:00	Y-phase, Zone-1, , A/R L/O	Y- phase, Zone-1, SOTF/T OR ,A/R L/O	1	0	0	1	0	0	#	#	#	Relay at Baruipur end is to be checked
13	Newtown AA3- Baruipur #1	11.05.24	20:35:00	12.05.24	14:43:00	No tripping. Manual OFF of the bay		0		1		0		#	#	#	Manual off of the Feeder due to glowing at the Cable head at PG end.
14	Gokarna- Sagardighi #1	16.05.24	17:43:00	16.05.24	18:52:00	B-phase, Zone-1, A/r optd., A/R L/O		1		0		0		1	1	1	

15	Gokarna-Sagardighi #2	16.05.24	17:43:00	16.05.24	18:29:00	B-phase, Zone-1, A/r optd., A/R L/O		1		0		0		1	1	1	
16	Jeerat- New Chanditala	22.05.24	11:42:00	22.05.24	12:29:00	B-phase, Zone-1, A/R L/O	B-phase, Zone-1, A/R L/O	1	1	0	0	0	0	1	1	1	OPGW laying work is running. A/R switch kept Off during working time.
17	Durgapur-PPSP#2	30.05.24	21:47:00	30.05.24	22:16:00	B-phase, Zone-1, , A/R L/O		1		0		0		1	1	1	Heavy storm and thundering weather

Annexure B.9

List of important transmission lines in ER which tripped in May-2024

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/EL RECEIVED FROM LOCAL END	DR/EL RECEIVED FROM REMOTE END	LOCAL END UTILITY	REMOTE END UTILITY
1	400KV-JAMSHEDPUR-MAITHON-1	01-05-2024	14:45	01-05-2024	16:04	Jamshedpur : F/D: 112.9 Km, F/C: 2.96 kA	Maithon: F/D: 26.8 Km, F/C: 7.4 kA, Z1	R-Earth	100	A/r successful at Jamshedpur, tripped again within reclaim time. No A/r attempt at Maithon.		Yes	Yes	PG ER-2	PG ER-1
2	400KV-BINAGURI-TALA-4	01-05-2024	23:41	02-05-2024	17:25	Binaguri: DT Received	Bhutan: Y_B_N, Iy:8.51 kA, Ib:7.98 kA, 1 km	Y-B-Earth		Phase to phase resistive fault close to Tala. DT received at Binaguri.		No	No	PG ER-2	Bhutan

3	220KV-BOLANGIR (PG)-KESINGA-1	02-05-2024	14:47	02-05-2024	15:58	Bolangir: R-N, 1.4 kA, 68 km		R-Earth	100	A/r successful from Bolangir only.		Yes	No	PG Odisha	OPTCL
4	220KV-DARBHANGA (DMTCL)-DARBHANGA-1	03-05-2024	01:27	03-05-2024	04:08	Darbhangha: Distance protection operated		R-Earth	100	A/r couldn't be ascertained from PMU		Yes	No	DMTCL	BSPTCL
5	400KV-FSTPP-MALDA(PG)- 1	03-05-2024	01:28	03-05-2024	06:19	B-Phase Faulty Isolator malfunction at FSTPS switchyard end.	Malda: DEF operated.	No fault	NA	At 01:28:04 Hrs, B_ph current reduced to around 20 A at Farakka and then after 10 seconds DEF operated at Malda and DT sent to Farakka. NTPC may explain the	DR not time synchroni zed and DR channels not configured properly at Farakka.	Yes	Yes	NTPC	PG ER- 2

6	400KV-JHARSUGUDA-STERLITE-2	03-05-2024	12:11	03-05-2024	15:40	Jharsuguda: Y_N, 6.92 kA, 35.7 Km		Y-Earth	100	A/r failed after 1 second		Yes	No	PG Odisha	Sterlite
7	220KV-JSPL-JAMSHEDPUR(DVC)-1	03-05-2024	12:32	03-05-2024	16:03	JSPL: Y_N, 0.718 kA	Jamshedpur: Y-N, Zone-2, 147 km, 0.77 kA	Y-Earth	500	Resistive phase to phase fault		No	No	OPTCL	DVC
8	400KV-PATNA-BARH-1	04-05-2024	11:02	04-05-2024	11:58	Patna: DT received	Maintenance work of 220V chargers were in progress at barh and due to voltage fluctuation during switching may cause line tripping.	No fault	NA	NTPC Barh may explain	DR not configured properly at Barh. Prefault time for DR recording is very less	Yes	No	NTPC	PG ER- 1

9	400KV-KHSTPP-BARH-2	04-05-2024	11:02	04-05-2024	11:59	Kahalgaoon: Didn't trip	Maintenance work of 220V chargers were in progress at barh and due to voltage fluctuation during switching may cause line tripping.	No fault	NA	NTPC Barh may explain		NA	No	NTPC	PG ER-1
10	220KV-TENUGHAT-BIHARSARIEFF-1	05-05-2024	14:06	05-05-2024	14:50	Tenughat: B_N, 1.099 kA, 119.5 km	Biharshariff: B_N, Z-1, 48.99 km, 2.334 kA	B-Earth	100	Three phase tripping for single phase fault		Yes	No	TVNL	BSPTCL
11	220KV-BUDHIPADAR-KORBA-2	05-05-2024	14:40	07-05-2024	12:00	Budhipadar: Didn't trip		No fault	NA	No fault observed from PMU		NA	No	OPTCL	WR

12	400KV-BOLANGIR (PG)- ANGUL-1	05-05-2024	15:34	05-05-2024	16:03	Bolangir: R-N, 0.84 kA, 168 km	Angul: R- N,12.58 kA, 16.8 Km, Z1	R-Earth	100	A/r successful. Tripped again within reclaim time.		Yes	Yes	PG Odisha	OPTCL
13	220KV-DALTONGANJ- CHATRA-1	06-05-2024	11:46	06-05-2024	12:49	Daltonganj : Y_B, 43.43 Km, Iy-2.5 KA, Ib-2.44 KA	Chatra: Y_B, 105.04 km	Y-B	100	Phase to phase fault.	DR not time synchroni zed at Chatra	Yes	Yes	PG ER- 1	JUSNL
14	220KV-RANCHI- MTPS(DVC)-1	06-05-2024	15:42	06-05-2024	16:26	Ranchi: R_N, 97 km, 1.9 kA,A/R successful	Mejia: R_N, 1.332 kA	R-Earth	100	A/r kept disabled at Mejia		Yes	No	PG ER- 1	DVC

15	220KV-TSTPP-MEERAMUNDALI-2	06-05-2024	15:49	06-05-2024	19:24	TSTPP:R_N, 31.7 km, 3.87 kA	Meramundali: R-N, 12.03 Km, 9.853 KA	R-Earth	100	A/r successful. Tripped again within reclaim time.		No	Yes	NTPC	OPTCL
16	400KV-BARIPADA-TISCO-1	06-05-2024	18:28	06-05-2024	19:51	Baripada:R_N, 75 km, 3.2 kA	TISCO: R-N, 50.7 km, 3.69 kA	R-Earth	100	Three phase tripping for single phase fault		No	No	PG Odisha	TISCO
17	400KV-MEDINIPUR-KHARAGPUR-2	06-05-2024	19:35	06-05-2024	21:16	Medinipur:R-Y, 84.36 km, Ir-3.55 kA, Iy-3.55 kA	Kharagpur: R-Y, 22.72 Km,Ir:8.728 KA, Iy:8.821 KA	R-Earth	100	Initially fault in R_ph. After 110 msec, fault struck Y_ph and all three phase tripped	DR not time synchronized at Kharagpur	Yes	Yes	PMJTL	WBSE TCL

18	400KV-KOLAGHAT-KHARAGPUR-2	06-05-2024	19:43	06-05-2024	20:01	Kolaghat: B_N,33.47 Km,7.789 KA	Kharagpur: B_N. 4.81 kA	B-Earth	100	A/r successful. Tripped again within reclaim time.	DR not time synchroni zed at Kharagpur	No	Yes	WBPD CL	WBSE TCL
19	220KV-RANCHI-MTPS(DVC)-1	06-05-2024	19:44	08-05-2024	17:49	Ranchi: B_N ,116 km,1.6 kA	Mejia:-B_N, 1.77 kA	B-Earth	100	A/r unsuccessful after 1 second at Ranchi. A/r kept disabled at Mejia, however other two phase tripped on PD later		Yes	No	PG ER- 1	DVC
20	400KV-KOLAGHAT-NEW CHANDITALA-1	06-05-2024	20:02	06-05-2024	20:37		New Chanditala: B-N, Z1, 45.07 Km,5.989 KA	B-Earth	100	A/r failed after 1 second		No	Yes	WBPD CL	WBSE TCL

21	220KV-BARUIPUR-SUBHASGRAM(PG)-1	06-05-2024	20:06	06-05-2024	22:33	Baruipur : B_N, 22.3 Km, 0.8 kA	Subhashgram: B_N, 5.77 kA	B-Earth	100	Three phase tripping at Baruipur for single phase fault. A/r successful at Subahshgram, phase to phase fault within reclaim time.	DR not time synchronized at Subhashgram.	Yes	Yes	WBSET CL	PG ER- 2
22	400KV-KOLAGHAT-KHARAGPUR-2	06-05-2024	20:15	06-05-2024	20:31		Kharagpur: B_N,97.04 Km, 3.515 KA	B-Earth	100	DT received at Kharagpur and all three phase tripped.	DR not time synchronized at Kharagpur	No	Yes	WBPD CL	WBSE TCL
23	400KV-KOLAGHAT-ARAMBAGH-1	06-05-2024	20:15	06-05-2024	20:36		Arambagh: B_N, 4.99 kA	B-Earth	100	A/r successful. Tripped again within reclaim time.		No	Yes	WBPD CL	WBSE TCL

24	220KV-RAJARHAT-BARASAT-2	06-05-2024	20:29	06-05-2024	21:10	Rajarhat: R_N, 5.6 km, 11.04 kA	Barasat: R_N, Z-I, 13.1 km, 6.88 kA	R-Earth	100	DT received at Rajarhat which was then relayed back to Barasat and three phase tripped at both ends.		Yes	Yes	PG ER-2	WBSE TCL
25	220KV-SAHARSA(PMTL)-BEGUSARAI-2	06-05-2024	21:15	07-05-2024	00:12	Saharsa: Didn't trip	Tripped from Begusarai end only	No fault	NA	No fault observed from PMU. BSPTCL may explain.		NA	No	PMTL	BSPTCL
26	400KV-JEYPORE-BOLANGIR-1	07-05-2024	05:29	07-05-2024	06:57	Jeypore: DT received	Bolangir: O/V stage-1	O/V St.1	NA	O/V stage 1		Yes	Yes	PG Odisha	PG Odisha

27	400KV-JEYPORE- GAJUWAKA-1	07-05-2024	05:29	07-05-2024	07:00	O/V Stg-1 operated at Jeypore		O/V St.1	NA	operated		Yes	NA	GAJUW AKA	SR
28	220KV-BOLANGIR (PG)- KESINGA-1	07-05-2024	07:15	07-05-2024	07:44	Bolangir: Y-B , Iy-1.08 kA, Ib-1.08 kA, 80 km		Y-B	800	Tripped in Zone-3 from Bolangir. Whether any fault in downstream of Kesigna. OPTCL may share		Yes	No	PG Odisha	OPTCL
29	400KV-MAITHON-GAYA-1	07-05-2024	17:15	07-05-2024	18:09	Maithon: DT received	Gaya: R-N, 41 km, 4.2 kA, DEF operated	R-Earth	1000	DEF operated after 1 second at Gaya and DT sent to remote end. Very less dip in voltage, hence distance protection didn't operate despite continuous high current.	DR of another tripping attached at Maithon	No	Yes	PG ER- 2	PG ER- 1

30	400KV-TENUGHAT-PATRATU-1	07-05-2024	17:42	08-05-2024	13:19		Patratu: Didn't trip	No fault	NA	No fault as per PMU. TVNL may explain.		No	No	TVNL	PVUNL
31	220KV-RANCHI-HATIA-2	07-05-2024	17:59	07-05-2024	19:05	Ranchi: Y_N, A/r successful	Hatia: Y-N, 6.15 kA	Y-Earth	100	A/r successful at Ranchi only. Three phase tripping at Hatia.	DR not time synchronized at Hatia	Yes	Yes	PG ER-1	JUNSNL
32	400KV-RANCHI-NEW RANCHI-1	07-05-2024	18:10	08-05-2024	12:10	Ranchi: B-N, 27 km, 10.27 kA	New Ranchi: B_N, 7 kA	B-Earth	100	A/r failed at Ranchi and DT sent to remote end after A/r failure.		Yes	Yes	PG ER-1	PG ER-1

33	400KV-RANCHI-SIPAT-2	07-05-2024	18:23	08-05-2024	17:59	Ranchi: Y-N, 23.2 km, 9.4 kA		Y-Earth	100	A/r unsuccessful after 1.2 seconds		Yes	NA	PG ER- 1	WR
34	220KV-DARBHANGA (DMTCL)-DARBHANGA-1	07-05-2024	18:50	07-05-2024	20:49	DMTCL: Didn't trip	Darbhangha: R-N, 1.71 kA, dist= -75.7 km	R-Earth	100	BSPTCL may share fault details.		No	No	DMTCL	BSPTCL
35	220KV-SAHARSA- BEGUSARAI-2	07-05-2024	19:06	08-05-2024	16:16	Saharsa: R-N, 13.2 kA, 6.1 km		R-Earth	100	Three phase tripping at Saharsa. A/r successful at Begusarai.		Yes	No	PMTL	BSPTCL

36	400KV-KHSTPP-BARH-1	07-05-2024	19:55	08-05-2024	19:34		BARH:- B-N, 88.57km, 4.9kA	B-Earth	100	A/r unsuccessful at Barh, however other two phase at Barh didn't open after failed A/r attempt. Later tripped on PD after 2.5 seconds.		No	Yes	NTPC	NTPC
37	400KV-NEW PPSP- ARAMBAGH-1	07-05-2024	20:27	07-05-2024	20:44		Arambag: B- N, 5.28kA, 56.75Km	B-Earth	100	A/r failed after 1 second		No	Yes	WBSET CL	WBSE TCL
38	220KV-RANCHI- RAMGARH-1	07-05-2024	20:37	08-05-2024	02:41	Ranchi: R_Y, Ir: 8.6 kA, Iy: 6.9 kA		R-Y	100	Phase to phase fault		Yes	No	PG ER- 1	DVC

39	220KV-MAITHON(PG)-DUMKA-2	07-05-2024	20:48	07-05-2024	22:15	Maithon: R_N, A/R Successful	Dumka- R_N, 2.629 kA, 25.12 km	R-Earth	100	Three phase tripping at Dumka.	DR not time synchronized at Dumka. DR length less at both ends.	Yes	Yes	PG ER-2	JUSNL
40	400KV-MAITHON-MEJIA-2	07-05-2024	21:16	08-05-2024	10:02	Maithon : B-N, 12.4 Km, 9.26 kA		Y-Earth	100	A/r failed after 1 second		Yes	No	PG ER-2	DVC
41	400KV-ARAMBAGH-BAKRESWAR-1	07-05-2024	22:10	07-05-2024	22:19	Arambagh: R_N, 3.61 kA		R-Earth	100	Other two phase at Arambagh tripped after 200 msec. A/r successful at Bakreshwar		Yes	No	WBSET CL	WBPD CL

42	400KV-NEW DUBURI-MEERAMUNDALI-2	08-05-2024	17:54	08-05-2024	19:38		Meeramundi : R_N,A/R Unsuccessful , 37.2 Km, 6.98 kA,	R-Earth	100	A/r failed after 1 second		Yes	Yes	OPTCL	OPTCL
43	220KV-RAJARHAT-BARASAT-1	08-05-2024	19:06	08-05-2024	20:57	Rajarhat: DT received		No fault	NA	DT received at Rajarhat. WBSETCL may explain.		Yes	Yes	PG ER-2	WBSETCL
44	220KV-DARBHANGA (DMTCL)-DARBHANGA-1	09-05-2024	09:11	09-05-2024	10:55	DMTCL: Didn't trip	Darbhangha - R_N, 2 kA	No fault	NA	Tripped immediately during fault in adjacent line. BSPTCL may explain.	DR length less at DTMCL	Yes	No	DMTCL	BSPTCL

45	220KV-DARBHANGA (DMTCL)-DARBHANGA-2	09-05-2024	09:11	09-05-2024	13:45	Darbhanga (DMTCL):-R-N, 13.97 kA,1.8 km, Z-1	Darbhanga - R_N, 13.8 kA	R-Earth	100	Three phase tripping for single phase fault.	DR length less at DTMCL	Yes	No	DMTCL	BSPTCL
46	220KV-DARBHANGA(DMTCL)-LAUKAHI-1	09-05-2024	09:45	09-05-2024	12:00	Darbhanga (DMTCL) :-R-N, 2.13 km, 15.45 kA, Z-1		R-Earth	100	A/r successful at Laukahi only.	DR length less at DTMCL	Yes	No	DMTCL	BSPTCL
47	220KV-SAHARSA-BEGUSARAI-1	09-05-2024	10:35	09-05-2024	12:06	Saharsa:-R-N, 25.03 km, 5.14 kA, Z-1	Begusarai: R-N, 61.51Km, 2.21 KA.	R-Earth	100	A/r successful. Tripped again within reclaim time.		Yes	No	PMTL	BSPTCL

48	220KV-RENGALI (PH)-TSTPP-1	09-05-2024	14:57	09-05-2024	19:50		TSTPP: R_N, 17 Km, 5.09 KA	R-Earth	100	Three phae tripping for single phase fault		No	No	OHPC	NTPC
49	220KV-TTPS-TSTPP-1	09-05-2024	14:57	09-05-2024	16:31		TSTPP: Y_N	Y-Earth	100	Three phae tripping for single phase fault		No	No	OPTCL	NTPC
50	400KV-DSTPS(ANDAL)-RAGHUNATHPUR-2	09-05-2024	15:21	10-05-2024	15:07		Raghunathpur:R_N, 8.574 kA, 26.16 Km	R-Earth	100	A/r failed after 1 second		No	No	DVC	DVC

51	220KV-MAITHON-KALYANESHWARI-1	09-05-2024	15:25	09-05-2024	19:55	Maithon:R_N, 2.2 km, 13.5 kA		R-Earth	100	Other two phase at Maithon opened after 1.5 seconds. No A/r attempt at either end.	Yes	No	PG ER-2	DVC
52	400KV-MAITHON-DURGAPUR-1	09-05-2024	15:45	10-05-2024	13:22	Maithon : R_N, 38.6 Km, 2.61 KA;	Durgapur : R_N, 10 Km,7.04 KA;	R-Earth	100	A/r failed after 1 second	Yes	Yes	PG ER-2	PG ER-2
53	220KV-DARBHANGA (DMTCL)-DARBHANGA-1	09-05-2024	16:26	09-05-2024	17:26		Darbhangha : DEF, R_N, 0.27 kA	R-Earth	500	Resistive fault. DEF operated after 500 msec. Current in R_ph despite breaker trip command. BSPTCL may explain. DEF settings may be reviewed.	No	Yes	DMTCL	BSPTCL

54	220KV-JODA- RAMCHANDRAPUR-1	09-05-2024	17:45	09-05-2024	18:56		Ramchandra pur: B_N, 120.6 km, 1.8 kA	B-Earth	400	Tripped in Zone-2 time from Ramchandrap ur	DR not time synchroni zed nad DR channels not configured properly at Joda. DR length less at both ends	Yes	Yes	JUSNL	OPTCL
55	400KV-JHARSUGUDA- RAIGARH-1	10-05-2024	21:46	10-05-2024	22:24	Jharsuguda: B_N, 5.08 kA		B-Earth	100	No A/r attempt at Jharsuguda. Ar/ successful at Raigarh after 1.2 seconds. Other two phase at Jharsuguda tripped after 3 seconds. PG Odisha may explain.		Yes	NA	PG Odisha	WR
56	220KV-NewTown- Subhashgram-Baruipur	11-05-2024	10:56	11-05-2024	12:43	NewTown: R_N, 7.0 kA	Baruipur : R_N, 16.3 km, 0.89kA	R-Earth	100	A/r successful at New Town only	DR not itme synchroni zed at New Town	Yes	Yes	WBSET CL	WBSE TCL

57	400KV-KHSTPP-BARH-1	11-05-2024	11:30	11-05-2024	12:00		DT Received at Barh	No fault	NA	DT received at Barh. No fault in line. NTPC KhSTPP may explain.	Yes	No	NTPC	NTPC
58	400KV-TENUGHAT-PVUNL-1	11-05-2024	13:29	11-05-2024	14:29	Tenughat: B_N, 1.599 kA	Baruipur: Z1, 19.4 km, Y ph, E/F, FC: Y Phase: 4 kA	B-Earth	100	A/r couldn't be ascertained from PMU. TVNL may confirm.	No	No	TVNL	PVUNL
59	220KV-NewTown-Subhashgram-Baruipur	11-05-2024	13:59	11-05-2024	14:21	New Town : Y_N, 20 km, 2 kA	Baruipur: Y_N, 19.4 km, 4 kA	Y-Earth	100	Three phase tripping for single phase fault at Baruipur. Whether A/r attempted at NewTown? WBSETCL may confirm	Yes	No	WBSETCL	WBSETCL

60	220KV-DALTONGANJ-CHATRA-1	11-05-2024	14:37	11-05-2024	15:34	B_N, 0.965 kA		B-Earth	1300	Tripped in Zone-2 time from Daltonganj. Carrier received at Daltonganj but at that time fault was not seen in any zone. Later when current increased. it	Chatra end is not time synchronized	Yes	Yes	PG ER-1	BSPTCL
61	220KV-BARIPADA-BALASORE-1	11-05-2024	15:44	11-05-2024	16:17	Baripada: R_N, 2.74 KA, 79.09 Km	Balasore: R_N, 0.8 Km, 7.4 KA	R-Earth	100	A/r successful after 1 second. Line tripped from Balasore after 5 seconds. OPTCL may explain.		No	Yes	PG Odisha	OPTCL
62	765KV-JHARSUGUDA-RAIPUR PS (DURG)-2	11-05-2024	17:05	11-05-2024	22:12	Jharsugda: R-Y, Ir-5.62 kA, Iy-4.64 kA, 36.1Km	Raipur: R-Y ph, 61.714 km	R-Y-Earth	100	Phase to phase fault.		Yes	NA	PG Odisha	WR

63	400KV-MAITHON-MEJIA-1	11-05-2024	17:10	11-05-2024	17:40	Maithon : R-N, 13.08 kA, 5.8 Km	Mejia: R-N, 3.176 KA, 50.46 Km	R-Earth	100	Three phase tripping at Maithon. A/r successful from Mejia only.	Yes	No	PG ER-2	DVC
64	765KV-NEW RANCHI-DHARAMJAIGARH-1	11-05-2024	18:12	11-05-2024	21:35	New Ranchi : R-N, 2.9 km,12.4 kA		R-Earth	100	A/r failed after 1 second	Yes	No	PG ER-1	WR
65	220KV-RENGALI(PH)-TSTPP-1	11-05-2024	21:00	15-05-2024	22:33	Rengali-O/C Tripped	TSTPP :R-N, Z-2,25 km, 4.3 kA	R-Earth	100	As per PMU, fault in R_ph during A/r.	No	No	OHPC	NTPC

66	220KV-SITAMARHI-RAXAUL(NEW)-1	12-05-2024	05:34	12-05-2024	06:47	Sitamari: B_N, 72.8 km, 2.31 kA	Raxaul: B-N, 15 km, 1.5 kA	B-Earth	100	Tripped again within reclaim time		Yes	Yes	PG ER-1	BSPTCL
67	220KV-SITAMARHI-RAXAUL(NEW)-2	12-05-2024	05:42	12-05-2024	06:47	Sitamari: B_N, 74.9 km, 1.94 kA	Raxaul: B-N, 36 km, 3.1 kA	B-Earth	100	Tripped again within reclaim time		Yes	Yes	PG ER-1	BSPTCL
68	220KV-DARBHANGA (DMTCL)-DARBHANGA-1	12-05-2024	12:23	12-05-2024	13:30	DMTCL: Didn't trip	Darbhangha: B_N, 1.53 kA	B-Earth	100	Tripped from BSPTCL only. BSPTCL may explain.		No	No	DMTCL	BSPTCL

69	220KV-PUSAULI-KARAMNASHA-1	12-05-2024	17:44	12-05-2024	18:35	Pusauli : B_N, 6.729 KA, 16.494 Km	Karamanasa: B_N, 2.181 kA, 9.086 Km	B-Earth	100	A/R successful from Pusauli end only. Other two phase at Karamnasha tripped later on PD. BSPTCL may explain.	No	Yes	PG ER- 1	BSPTC L
70	765KV-GAYA-VARANASI- 2	12-05-2024	18:04	12-05-2024	19:18	GAYA : R_N, 104.7 km, 3.98 kA	Varanasi: R_N, 128.2 km, 4.65 kA	R-Earth	100	A/r failed after 1 second	Yes	No	PG ER- 1	NR
71	220KV-PUSAULI-KARMNASHA-1	12-05-2024	18:49	12-05-2024	19:42	Pusauli: B_N, 6.32 kA		B-Earth	100	A/r successful from Pusauli. Other two phase at Karamanasha tripped on PD after 1.8 seconds.	Yes	No	PG ER- 1	BSPTC L

72	400KV-NEW DUBURI-MEERAMUNDALI-2	13-05-2024	00:58	13-05-2024	08:08	New Duburi: R_N, 4.65 kA, 56.7 km	Meeramundali: R-N, 9 kA, 37.4 km	R-Earth	100	A/r failed after 1 second		Yes	Yes	OPTCL	OPTCL
73	220KV-DALTONGUNJ-GARWAH (NEW)-1	13-05-2024	14:16	13-05-2024	16:02	Daltongunj: Y_N, 3.09kA, 30.47 km	Garwah: Y_N, 0.60 kA, 63.90 Km	Y-Earth	100	A/r successful. Tripped again within reclaim time.	DR not itme synchronized at Garhwa	Yes	Yes	PG ER-1	JUSNL
74	400KV-SAGARDIGHI-FSTPP-2	14-05-2024	15:25	14-05-2024	18:25	Sagardighi - R_N, 70.15 km , 3.3 kA	FSTPP - R_N, 4 kA	R-Earth	100	No A/r attempt at either end.	DR channels not configured properly and DR length less at Farakka.	Yes	Yes	WBPD CL	NTPC

75	400KV-DURGAPUR-KHSTPP-1	14-05-2024	15:42	14-05-2024	16:24	Durgapur: Y-N, 134.9 km, 2.46kA	KHSTPP: Y-N, 90.94 km, 4.5 kA	Y-Earth	100	A/r successful from Durgapur only. Other two phase at Kahalgaon tripped on PD.	Yes	No	PG ER-2	NTPC
76	400KV-KHSTPP-BARH-1	14-05-2024	17:42	14-05-2024	18:04	Kahalgaon: Didn't trip	Barh: DT received	No fault	NA	No fault in line. NTPC may explain.	Yes	No	NTPC (BARH)	NTPC (KHSTPP)
77	220KV-BOLANGIR(PG)-BOLANGIR(GRIDCO)-2	15-05-2024	11:51	15-05-2024	12:10	Bolangir(PG): DT received		No fault	NA	No fault in line as per PMU. OPTCL/PG Odisha may explain.	No	No	PG Odisha	OPTCL

78	765KV-JHARSUGUDA-RAIPUR PS (DURG)-2	15-05-2024	19:48	15-05-2024	22:33	Jharsuguda: R-N, 4.3 kA, 270 Km		R-Earth	100	A/r failed after 1 second		Yes	NA	PG Odisha	WR
79	400KV-DURGAPUR-KHSTPP-2	16-05-2024	16:20	17-05-2024	08:47	Durgapur:-B- N,157.0 km,2.35 kA	KHSTPP: B_N, 81 km, 5.5 KA	B-Earth	100	A/r failed after 1 second from Durgapur. No A/r attempt at Kahalgaon, other two phase tripped later on PD after 2.5 seconds.		Yes	No	PG ER- 2	NTPC (KHST PP)
80	400KV-GOKARNA-SAGARDIGHI-2	16-05-2024	17:43	16-05-2024	18:46	Gokarna: B_N, 13.80 Km, 13.12 KA	Sagardighi- B_N, 27.47 km, 15.25 KA	B-Earth	100	A/r successful. Tripped again within reclaim time.		Yes	No	WBSET CL	WBPD CL

81	400KV-GOKARNA-SAGARDIGHI-1	16-05-2024	17:43	16-05-2024	18:55	Gokarna: B_N, 16.09 km, 8.645 kA	Sagardighi-B_N, 21.78 km, 12.31 kA	B-Earth	100	A/r failed after 1 second		Yes	No	WBSET CL	WBPD CL
82	220KV-CHUKHA-BIRPARA-1	16-05-2024	21:38	16-05-2024	22:24		Birpara: R-Y, Z1, FD-41.34 Km, Ir-2.758 kA, Iy-2.942 KA	R-Y-Earth	100	Phase to phase fault.	DR not time synchronized at Birpara	No	Yes	BHUTAN	PG ER-2
83	220KV-CHUKHA-BIRPARA-2	16-05-2024	21:38	16-05-2024	22:26		Birpara: R-Y, Z1, FD- 41.8 Km, Ir-3.355 kA, Iy-2.942 KA	R-Y-Earth	100	Phase to phase fault.		No	Yes	BHUTAN	PG ER-2

84	220KV-PUSAULI-NADHOKAR-1	17-05-2024	11:04	17-05-2024	12:24	Pusauli: AR Lockout, 86 master trip		No fault	NA	No fault observed as per PMU. PG ER-1/BSPTCL may explain.		No	No	PG ER-1	BSPTCL
85	220KV-PUSAULI-NADHOKAR-2	17-05-2024	11:04	17-05-2024	12:27	Pusauli: AR Lockout, 86 master trip		No fault	NA	No fault observed as per PMU. PG ER-1/BSPTCL may explain.		No	No	PG ER-1	BSPTCL
86	400KV-BINAGURI-TALA-2	18-05-2024	09:25	18-05-2024	13:23	Binaguri : B-N, 120.5 Km,3.2311 KA	Tala: B-N,35 Km,4.07 kA	B-Earth	100	DT received at Binaguri and all three phase tripped.		Yes	No	PG ER-2	BHUTAN

87	220KV-RANCHI-HATIA-3	19-05-2024	14:32	19-05-2024	16:36	Ranchi: B_N,40 km, 4.9 kA	Hatia: B_N, 10.55 kA,3.5 km	B-Earth	100	A/r successful. Tripped again within reclaim time.	DR not time synchronized and DR length less at Hatia	Yes	Yes	JUSNL	PG ER-1
88	220KV-RANCHI-HATIA-1	19-05-2024	14:57	19-05-2024	15:49	Ranchi: B_N, 6.50 kA	Hatia: B_N, 4.09 kA	B-Earth	100	A/r successful. Tripped again within reclaim time.	DR not time synchronized and DR length less at Hatia	Yes	Yes	JUSNL	PG ER-1
89	400KV-BINAGURI-KISHANGANJ-2	19-05-2024	23:35	20-05-2024	00:53	Binaguri: Y_N, 88.6 Km , 2.15 kA	Kishanganj - Y-N, 0.603 km, 21.39 kA	Y-Earth	100	After 90 msec, fault struck B_ph also and three phase tripped.		Yes	Yes	PG ER-2	PG ER-1

90	220KV-RENGALI(PH)-TSTPP-1	20-05-2024	21:03	20-05-2024	23:34	Rengali: R_N, 5.2 KA	TSTPP: R_N,7.8 Km, 7.3 kA	R-Earth	500	Tripped in Zone-2 time.		No	No	OPTCL	TSTPP
91	400KV-MERAMUNDALI-LAPANGA-1	20-05-2024	21:45	Still not revived		Meramundali: B_N, 16.7 km, 6.8 kA		R-Earth	100	Fault first struck R_ph and after 700 msec fault struck B_ph and all three phase tripped.		Yes	Yes	OPTCL	OPTCL
92	400KV-MERAMUNDALI-LAPANGA-2	20-05-2024	21:45	Still not revived		Meramundali: R_N, 16.9 km, 10.87 kA		Y-Earth	100	Fault first struck Y_ph and after 500 msec, fault converted to R_Y fault and all three phase tripped.		Yes	Yes	OPTCL	OPTCL

93	765KV-GAYA-VARANASI-2	21-05-2024	05:07	21-05-2024	06:13	Gaya:R-N, 109.4 km, 5.05 KA	Varanasi: R-N, 146 km, 5.0 KA	R-Earth	100	A/r successful. Tripped again within reclaim time.		Yes	NA	PG ER-1	NR
94	220KV-JODA-RAMCHANDRAPUR-1	21-05-2024	12:16	21-05-2024	12:43	Joda: Y_N, 101.7 km, 0.75 kA	Ramchandra pur: Y_N, 31.2 Km, 3.08 kA	Y-Earth	100	Three phase tripping at Rmachandrapur. A/r successful at Joda, however after 200 msec line tripped again due to persisting fault.	DR not time synchronzied at Joda. DR length less at both ends.	Yes	Yes	OPTCL	JUSNL
95	220KV-TSTPP-MEERAMUNDALI-1	21-05-2024	14:40	21-05-2024	15:09	TSTPP: B_N, 27km, 4.06 kA	Meeramundali: B_N, 3.2 kA	B-Earth	100	A/r failed after 1 second		No	Yes	NTPC	OPTCL

96	765KV-ANGUL-JHARSUGUDA-4	21-05-2024	16:53	21-05-2024	18:12	Angul: B-N, 331km, 3.05kA	Jharsuguda: B- N,28.8 Km,0.9 KA	B-Earth	100	A/r failed after 1 second	Yes	No	PG Odisha	PG Odisha
97	220KV-BUDHIPADAR-KORBA-1	22-05-2024	11:14	24-05-2024	21:43	Budhipadar : B_N, 32.1 Km, 4.05 KA	KORBA: B_N, 145.75 km, 1.03 kA	B-Earth	100	Three phase tripped at Budhipadar and A/r attempted after 1 second which failed due to persisting fault.	Yes	No	OPTCL	WR
98	400KV-JEERAT-NEW CHANDITALA-1	22-05-2024	11:42	22-05-2024	12:29	Jeerat: B-N, 34 Km, 7.2 kA	New Chanditala: B-N, 42.8 Km, 6.5kA	B-Earth	100	Three phase tripping from both ends for single phase fault	Yes	Yes	WBSET CL	WBSET CL

99	220KV-NEW MELLI-TASHIDING-2	22-05-2024	12:11	22-05-2024	13:03	New Melli: Y-B, 4.4 Km, Iy-2.871 kA, Ib-3.42 kA		Y-B-Earth	100	Phase to phase fault.		Yes	No	PG ER-2	BHUTAN
100	220KV-BUDHIPADAR-KORBA-2	22-05-2024	17:59	22-05-2024	22:36	Budhipadar: R-N, 173.9 km, 4.573 kA	Korba: R_N, 6.43 km, 13.2 kA	R-Earth	100	A/r successful. Tripped again within reclaim time.		Yes	NA	OPTCL	WR
101	220KV-DALTONGANJ-CHATRA-1	23-05-2024	13:05	25-05-2024	02:35	Daltonganj: B-N, 106.4 km, 1.2 kA		B-Earth	100	A/r successful. Tripped again within reclaim time.		Yes	No	PG ER-1	JUSUNL

102	220KV-PUSAULI-DEHRI-1	23-05-2024	15:24	23-05-2024	16:36	Pusauli: B-N, FD: 26 km,FC: 1.7 kA	Dehri: B-N, 1.49 kA	B-Earth	500	Tripped in Zone-2 time from Sasaram. A/r failed after 1 second at Dehri.	No	Yes	PG ER- 1	BSPTC L
103	220KV-JAYNAGAR- JEYPORE-4	23-05-2024	16:33	23-05-2024	18:41	Jaynagar: B- N, 6.05 km, 3.24 kA		B-Earth	100	A/r attempt couldn't be ascertained from PMU. PG Odisha/OPTC L may explain.	No	No	OPTCL	PG Odish a
104	220KV-CHAIBASA(PG)- CHAIBASA(JUSNL)-1	23-05-2024	16:33	23-05-2024	17:38	Chaibasa(PG): DT received	Chaibasa: Spurious tripping of breaker due to low SF6 gas pressure in R- Ph CT.	No fault	NA	JUSNL may explain	Yes	No	PG ER- 1	JUSUN L

105	400KV-LAPANGA-STERLITE-2	24-05-2024	12:08	24-05-2024	13:38	Lapanga: Iy-1.45 kA,Ib-1.63 kA, Ir-6.27 kA, FD: 11.42 km	Sterlite: Z-I, Ph: R-N, FC: 5 kA	R-N Fault	100	A/r successful. Tripped again within reclaim time.	DR length less. DR of fault instance not uploaded.	Yes	No	OPTCL	VEDANTA
106	220KV-TSTPP-MEERAMUNDALI-1	24-05-2024	15:30	25-05-2024	10:09		Meeramundali-R-N, 13.48 km, 10 kA	R-Earth	100	A/r failed after 1 second		No	Yes	NTPC	OPTCL
107	220KV-DALTONGANJ-CHATRA-1	25-05-2024	12:41	25-05-2024	13:29	Daltonganj : Y-B, 134.5 km, 1.27 kA	Chatra: Y-B, 41.33 km, Iy-1.03 kA , Ib-0.99 KA	Y-B	100	Phase to phase fault.		Yes	Yes	PG ER-1	JUSUNL

108	400KV-JEYPORE-BOLANGIR-1	25-05-2024	13:40	25-05-2024	14:01		Bolangir:B-N, 1.4 kA,181 km	B-Earth	100	A/r failed after 1 second		No	No	PG Odisha	PG Odisha
109	220KV-JODA-RAMCHANDRAPUR-1	25-05-2024	17:57	26-05-2024	22:07	Joda: R_N, 131.03 km, 1.367 kA	Ramchandra pur: Ph -R, CT blast	R-Earth	400	Tripped in Zone-2 time from Joda. 220 kV Bus-1 tripped at Ramchandrap ur		Yes	Yes	OPTCL	JUSUN L
110	400KV-DSTPS(ANDAL)-RAGHUNATHPUR-2	26-05-2024	10:29	26-05-2024	11:54	DSTPS: O/V	RTPS: B_N, 1.78 kA	B-Earth	950	As per PMU, Y_ph voltage shot up to 325 kV. O/V St.2 setting may be checked. 400/220 kV ICTs at DSTPS also tripped at the same time. DVC may explain the event.		No	Yes	DVC	DVC

111	220KV-NEW PURNEA-MADHEPURA-1	27-05-2024	13:05	27-05-2024	16:01	New Purnea: Y_B, 13.5 km, Iy: 9.79 kA, Ib: 9.59 kA	Madhepura: Y_B, 80.9 km, Iy: 2.5 kA, Ib: 2.49 kA	Y-B	400	Phase to phase fault. Tripped in Zone-2 from Madhepura.	No	No	PG ER- 1	BSPTC L
112	400KV-ALIPURDUAR (PG)- BONGAIGAON-2	27-05-2024	21:33	28-05-2024	03:52	Alipurduar- R_B, 38.5km, Ir-7.8 kA, Ib-7 kA	Bongaigaon- R-B, 55.53 km, 2.87 kA	R-B	100	Phase to phase fault	Yes	NA	PG ER- 2	NER
113	220KV-DALTONGANJ- CHATRA-1	28-05-2024	07:36	29-05-2024	14:51	Daltongunj - Y_B , 147 km, 1.055 kA		Y-B	400	Phase to phase fault. Tripped in Zone-2 from Daltonganj	No	No	PG ER- 1	JUSNL

114	220KV-JODA- RAMCHANDRAPUR-1	28-05-2024	10:28	28-05-2024	10:53	Joda: B_N, 77.36 km, 1.368 kA	Ramchandra pur: B_N, 54.7 km, 2.06 kA	B-Earth	100	Three phase A/r at Joda. A/r failed after 1 second		Yes	No	OPTCL	JUSNL
115	220KV-DEHRI-GAYA-2	28-05-2024	12:01	28-05-2024	12:56		Gaya: B_N,4.845 kA, 21.712 km	B-Earth	100	A/r successful. Tripped again within reclaim time.		No	No	BSPTC L	PG ER- 1
116	220KV-JODA- RAMCHANDRAPUR-1	28-05-2024	12:05	28-05-2024	12:30	Joda : B_N, 18.71 Km, 1.974 kA		B-Earth	100	A/r successful from Joda only. Line tripped from Rmachandrap ur after 2 seconds on O/c E/f.		Yes	Yes	OPTCL	JUSNL

117	220KV-JODA- RAMCHANDRAPUR-1	28-05-2024	16:02	28-05-2024	16:16	Joda : Y_N, 78 Km, 1.157 kA	Ramchandra pur: Y_N, 2.8 kA	Y-Earth	100	A/r successful from Joda. Three phase tripping at Ramchandrap ur		Yes	Yes	OPTCL	JUSNL
118	220KV-CHUKHA-BIRPARA- 2	28-05-2024	21:42	28-05-2024	22:28	Chuka: Z-1, Ph: R-B, (Master trip relay)	Birpara: R-B, 47.94 km, Ir- 2.318 kA, Ib- 2.834 kA.	R-B-Earth	100	Phase to phase fault		Yes	Yes	PG ER- 2	BHUT AN
119	220KV-CHUKHA-BIRPARA- 1	28-05-2024	21:42	28-05-2024	22:27	Chuka: Z-1, Ph: R-B, (Master trip relay)	Birpara: R-B, 47.73 km, Ir- 2.312 kA, Ib- 2.778 kA.	R-B-Earth	100	Phase to phase fault		Yes	Yes	PG ER- 2	BHUT AN

120	400KV-JHARSUGUDA-RAIGARH-1	29-05-2024	00:21	29-05-2024	20:15	Jharsuguda: Ph: B-N, FC:3.5 kA, FD: 105 km		B-Earth	500	Tripped in Zone-2 time from Jharsuguda		No	No	PG Odisha	WR
121	400KV-JHARSUGUDA-RAIGARH-3	29-05-2024	00:21	29-05-2024	03:22	Jharsuguda:Ph: R-N, FC: 2.85 kA, FD: 152 km.	Jharsuguda: R_N	Raigarh:- Main bay LBB protection operated at Raigarh SS due to R pole CB stuck during 400 KV BB 1	250	LBB operated at Raigarh.		No	No	PG Odisha	WR
122	400KV-MAITHON-MAITHON RB-2	29-05-2024	01:08	29-05-2024	02:01	Maithon: DT received	MPL: Didn't trip	No fault	NA	PG ER-2/MPL may explain.		No	No	PG ER-2	MPL

123	400KV-JAMSHEDPUR-TISCO-1	29-05-2024	06:49	29-05-2024	19:31	Jamshedpur: Y_N, Zone-2	TISCO: Ph: Y (Insulator brust)	Y-Earth	400	Tripped in Zone-2 from Jamshedpur	No	No	PG ER-1	DVC
124	400KV-JEYPORE-GAJUWAKA-2	29-05-2024	09:39	29-05-2024	12:11	Jeypore: DT received		No fault	NA	No fault as per PMU. PG Odisha may explain	No	NA	PG Odisha	SR
125	400KV-MAITHON-MAITHON RB-2	29-05-2024	10:37	29-05-2024	10:54	Tripped from Maithon End		No fault	NA	No fault as per PMU. PG ER-2/MPL may explain	No	No	PG ER-1	MPL

126	220KV-TENUGHAT-BIHARSARIEFF-1	29-05-2024	10:43	29-05-2024	19:29	Tenughat: B_N, 62.64 km, 1.806 kA		B-Earth	100	Three phase tripping for single phase fault		No	Yes	TVNL	PG ER-1
127	220KV-JODA-RAMCHANDRAPUR-1	29-05-2024	11:49	29-05-2024	12:23	Joda: R-N , 52.9 km, 2.5 kA		R-Earth	100	Three phase tripping for single phase fault		No	No	OPTCL	JUSNL
128	400KV-JEYPORE-BOLANGIR-1	29-05-2024	12:34	29-05-2024	14:51	Jeypore: Y_N, 100 Km, 2.2 KA Bolangir: Y_N, 1.439 kA, 163 Km		Y-Earth	100	A/r failed after 1 second		No	No	PG Odisha	PG Odisha

129	220KV-CHANDIL-RANCHI-1	29-05-2024	12:46	29-05-2024	13:05	Chandil: B_N, 78.3 KM,1.7 KA		B-Earth	500	Tripped in Zone-2 from Chandil		Yes	No	JUSNL	PG ER- 1
130	220KV-RENGALI(PH)- TSTPP-1	29-05-2024	13:13	29-05-2024	19:56	TSTPP: R_N, 13.3 Km, 5.03 KA		R-Earth	100	A/r couldn't be ascertained from PMU. NTPC/OHPC may confirm.		No	No	OPHC	NTPC(TSTPP)
131	400KV-MALBASE- BINAGURI-1	29-05-2024	19:37	29-05-2024	20:09	Binaguri: B- N, 17.3 km, 6.42 kA		B-Earth	100	A/r successful from Binaguri only. Three phase tripping at Malbase		No	Yes	PG ER- 2	BHUT AN

132	220KV-NEW MELLI-TASHIDING-1	29-05-2024	21:00	31-05-2024	10:30	New Melli : Y-N, 6.9 km, 12.3 kA		Y-Earth	100	A/r couldn't be ascertained from PMU		No	No	PG ER-2	BHUTAN
133	220KV-BUDHIPADAR-KORBA-1	30-05-2024	12:06	30-05-2024	18:17	Budhipadar:B_N, 128 km, 1.18 kA		B-Earth	100	Three phase A/r successful at Budhipadar. Tripped again within reclaim time.		Yes	NA	OPTCL	WR
134	220KV-KARAMNASHA (NEW)-SAHUPURI-1	30-05-2024	13:46	30-05-2024	15:45	Karmanasa: R_N, 1.65 kA, 103.4 km		R-Earth	350	O/c E/f operated at Karamnasha. Settings may be reviewed. Fault seems to be in Zone-3 of Karamnasha		Yes	NA	BSPTCL	NR

135	400KV-TENUGHAT-PVUNL-1	30-05-2024	18:28	30-05-2024	20:13	TTPS : B_N, Z-3, 1.33 kA, 80.6 Km		B-Earth	1000	Tripped in Zone-3 from Tenughat. TVNL/PVUNL may share findings.		No	No	TVNL	PVUNL
136	400KV-KODERMA-BOKARO-1	30-05-2024	19:34	30-05-2024	21:04	Koderma:R-N, 4.8 kA,76.2Km		R-Earth	100	Three phase tripping for single phase fault at Koderma. A/r couldn't be ascertained from PMU.	DR length less at Koderma	Yes	No	DVC	DVC
137	400KV-DHANBAD-RANCHI-1	30-05-2024	20:03	31-05-2024	15:13		Ranchi:Y_N, 7.264 kA, 44.637 km	Y-Earth	100	Fault struck B_ph after 800 msec of first fault		No	No	NKTL	PG ER-1

138	400KV-RANCHI-RAGHUNATHPUR-3	30-05-2024	20:14	Not revived yet			Raghunathpur : R-Y, FC: 4.19 kA	Y-Earth	100	As per PMU, fault first struck Y_ph and then after 200 msec, R_ph fault occurred.	No	Yes	PG ER-1	DVC
139	400KV-RANCHI-RAGHUNATHPUR-2	30-05-2024	20:14	Not revived yet			Raghunathpur : R,Y,B, Ir: 6.18 kA, Iy: 8.52 kA, Ib: 6.87 kA, 61.25 km	R-Y-B-Earth	100	Three phase fault.	No	Yes	PG ER-1	DVC
140	220KV-MAITHON-DHANBAD-2	30-05-2024	20:44	30-05-2024	22:00		Dhanbad: Y_B, Iy: 4.43 kA, Ib: 4.25 kA	Y-B	100	Phase to phase fault	No	Yes	PG ER-2	DVC

141	400KV-PPSP-BIDHANNAGAR-2	30-05-2024	21:47	30-05-2024	22:16	PPSP: B-N, 76.9 Km	Bidhannagar :B-N, 104.9 Km, 3.4 KA	B-Earth	100	A/r kept disabled as per OEM advise		No	Yes	WBSED CL	WBSE TCL
142	220KV-DARBHANGA(DMTCL)-LAUKAHI-1	30-05-2024	23:22	31-05-2024	10:19		Laukahi : Y-B ,Z-2, 83.10 Km, Iy-1.400 kA, Ib:1.5 kA	Y-B	100	Phase to phase fault		No	Yes	DMTCL	BSPTCL
143	220KV-DARBHANGA(DMTCL)-LAUKAHI-2	30-05-2024	23:32	31-05-2024	10:22	Darbhangar _N, 3.9 kA, 38.1 km		R-Earth	100	A/r successful from Laukahi only. Three phase tripping at Darbhanga.	DR not time synchronized at Laukahi	Yes	Yes	DMTCL	BSPTCL

**EASTERN REGIONAL POWER COMMITTEE
KOLKATA**

PROTECTION PROTOCOL OF EASTERN REGION

Prepared in Compliance to

Clause 12(2) and Clause 13 of Central Electricity Regulatory
Commission Indian Electricity Grid Code Regulations, 2023

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PROTECTION PROTOCOL OF EASTERN REGION

1. Background

1.1. The Protection Protocol of Eastern region is prepared in accordance with Clauses 12(2) & 13 of the Indian Electricity Grid Code, 2023 (IEGC 2023) notified by the Central Electricity Regulatory Commission.

1.1.1. The clause 12(2) of the IEGC 2023:

“There shall be a uniform protection protocol for the users of the grid:

- a) for proper co-ordination of protection system in order to protect the equipment/system from abnormal operating conditions, isolate the faulty equipment and avoid unintended operation of protection system;*
- b) to have a repository of protection system, settings and events at regional level;*
- c) specifying timelines for submission of data;*
- d) to ensure healthiness of recording equipment including triggering criteria and time synchronization; and*
- e) to provide for periodic audit of protection system.”*

1.1.2. The clause 13 of the IEGC 2023:

“13. Protection protocol

- (1) All users connected to the integrated grid shall provide and maintain effective protection system having reliability, selectivity, speed and sensitivity to isolate faulty section and protect element(s) as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA (Grid Standards) Regulations, 2010, the CEA Technical Standards for Communication and any other applicable CEA Standards specified from time to time.*
- (2) Back-up protection system shall be provided to protect an element in the event of failure of the primary protection system.*
- (3) RPC shall develop the protection protocol and revise the same, after review from time to time, in consultation with the stakeholders in the concerned region, and in doing so shall be guided by the principle that minimum electrical protection functions for equipment connected with the grid shall be provided as per the CEA Technical Standards for Construction, the CEA Technical Standards for Connectivity, the CEA Technical Standards for Communication, the CEA (Grid Standards) Regulations, 2010, the CEA (Measures relating to Safety and Electric Supply)*

Regulations, 2010, and any other CEA standards specified from time to time.

- (4) *The protection protocol in a particular system may vary depending upon operational experience. Changes in protection protocol, as and when required, shall be carried out after deliberation and approval of the concerned RPC.*
- (5) *Violation of the protection protocol of the region shall be brought to the notice of concerned RPC by the concerned RLDC or SLDC, as the case may be.”*

1.2. The Protection Protocol of Eastern Region stipulates General Protection Philosophy of Protection System, Protection Schemes for Generators & various Transmission Elements in Power System, Protection Settings & their Coordination among entities, Disturbance Monitoring, Analysis and Reporting, Time Synchronization of Protection Systems, Protection Audit Plan, Performance of Protection Systems & Compliance Monitoring.

2. Applicability

The Protection Protocol of Eastern Region shall be applicable to all Eastern Regional entities, State/Central/Private Generating Companies/ Generating Stations including REGs, RHGS, integrated RE with Pumped Storage Plant (PSP), SLDCs, ERLDC, CTU, STUs, Transmission Licensees and ERPC.

3. Definitions

Words and expressions used in this Protection Protocol are defined in the Act or any other regulations specified by the Central Commission or Central Electricity Authority shall, unless the context otherwise requires, have the meanings assigned to them under the Act or other regulations specified by the Central Commission, as the case may be.

4. General Philosophy of Protection System

4.1. Protection philosophy shall be in accordance with below mentioned objectives, design criteria and other details. However, protection design in a particular system may vary depending upon judgment and experience in the broad contours of the protection philosophy. Consideration must also be given to the type of equipment to be protected as well as the importance of this equipment to the system. Further, protection must not be defeated by the failure of a single component.

4.1.1. Objectives:

The basic objectives of any protection schemes should be to:

- (i) Automatically isolate the faulty element.
- (ii) Mitigate the effect of short circuit and other abnormal conditions in minimum possible time and area.
- (iii) Indicate the location and type of fault and

- (iv) Provide effective tools to analyses the fault and decide remedial measures.

4.1.2. **Design Criteria:**

To accomplish the above objectives, the four design criteria for protection that should be considered are:

- (i) fault clearance time/speed;
- (ii) selectivity;
- (iii) sensitivity and
- (iv) reliability (dependability and security)

4.1.2.1.**Fault clearance time/speed:** To minimize the effect on customers and maintain system stability, Fault clearance time shall be as per CEA Grid Standard Regulations 2010, as amended to date.

4.1.2.2.**Selectivity:** To ensure Selectivity, coordination shall be ensured with the adjacent protection schemes including breaker failure, transformer downstream relays, generator protection and station auxiliary protection.

4.1.2.3.**Sensitivity:** To ensure Sensitivity, the settings must be investigated to determine that they will perform correctly for the minimum fault current envisaged in the system, yet remain stable during transients and power swings from which the system can recover.

4.1.2.4.**Reliability:** To ensure Reliability, two independent auxiliary direct current-supplies shall be provided for Main-I and Main-II relays. The Main-I and Main-II relays should be from two different makes or operating with different algorithm. The CB's shall have two independent trip coils and two independent trip circuits. Each protection device should trip at least one of them by independent auxiliary DC- supplies.

4.1.2.5.**Security:** To ensure Security, the protection shouldn't limit the maximum transmission capacity of the element. Distance protection in particular could cause spurious tripping due to specific grid conditions, in case of high load operation. Therefore, any special topologies must be known and considered for protection parameterization. For parallel Over Head Lines it is necessary to consider the rapid increase of load current in the healthy line when the faulty line trips and the protection operation must allow such conditions The load encroachment detection function of the relays must be used, when the highest distance zone resistance reach conflicts with the maximum transmitted load on the protected element.

4.2. All generating units shall have standard protection system to protect the units not only from faults within the units and within the Station but also from faults in sub-stations and transmission lines.

4.3. The generator, generator transformer, unit auxiliary transformer shall be provided with protection systems connected to two independent channels or groups, such that one

channel or group shall always be available for any type of fault in the generator and these transformers;

- 4.4. Protection relays shall be configured in such a way that digital input points shall not pick up due to stray voltages.
- 4.5. Protective relays shall be used to detect electrical faults, to activate the alarms and disconnect or shut down the faulted apparatus to provide for safety of personnel, equipment and system.
- 4.6. Electrical faults shall be detected by the protective relays arranged in overlapping zones of protection.
- 4.7. The protection relays for the generators, motors, transformers and the transmission lines shall generally be of numerical type.
- 4.8. All relays used shall be suitable for operation with CTs secondary rated for one ampere or five amperes as per relevant Indian Standards or International Electrotechnical Commission or Institute of Electrical and Electronics Engineers standards.
- 4.9. Relevant Indian Standards or International Electrotechnical Commission or Institute of Electrical and Electronics Engineers standards shall be applied for protection of generators, transformers and motors.

5. Protection Schemes

The electrical protection functions for equipment connected with the grid shall be provided as per the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date, the CEA (Technical Standards for connectivity to the Grid) Regulations 2007 amended to date, the CEA (Technical Standards for Communication System in Power System Operation) Regulations 2020 amended to date, the CEA (Grid Standards) Regulations 2010 amended to date, the CEA (Measures relating to Safety and Electric Supply) Regulations 2023 amended to date, and any other CEA standards specified from time to time.

5.1. Thermal Generating Units

The electrical protection functions for generator, generator transformer, unit auxiliary transformer and station transformer shall be provided in accordance with but not limited to the list given in **SCHEDULE-I** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.

5.2. Hydro Generating Units

- 5.2.1. For the generating units with a rating of more than one hundred megawatt, protection system shall be configured into two independent sets of protection (Group A and B) acting on two independent sets of trip coil fed from independent DC supplies, using separate sets of instrument transformers, and segregated cables of current transformers and voltage transformers.

5.2.2. The protection functions for Generator, Excitation Transformer, Generator Transformer, Generator and Generator Transformer, Unit Auxiliary Transformer, and Station Auxiliary Transformer shall be provided in accordance with but not limited to the list given in SCHEDULE-IV of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date except for variable speed units which will have specialized protection functions.

5.3. REGs/RHGS/BESS

Protection Schemes for Renewable Energy (RE) Power Plants of Solar power generation, Wind power generation, Battery Energy Storage System (BESS) and Hybrid of these connected with grid at voltage level above 650 volts shall be in accordance with the Central Electricity Authority (Technical Standards for Construction of Renewable Energy Power Plants) Regulations, 2023 from the date as & when these regulations are notified (Presently the finalization of these Standards by CEA is under progress).

5.4. Substations & Transmission System Elements

5.4.1. All major protection relays for the Voltage levels 66 kV and above shall be of numerical type and communication protocol shall be as per IEC-61850.

5.4.2. Grouping of Protection systems for the voltage level 66 kV and above:

- i. The protection circuits and relays shall be electrically and physically segregated into two groups each being independent and capable of providing uninterrupted protection even in the event of one of the protection group fails or taken out for maintenance.
- ii. Interconnection between these two groups shall not generally be attempted. However, such interconnection shall be kept to the bare minimum, if found absolutely necessary.

5.4.3. The protections required in respect of transmission lines, transformers, reactors and bus bars but not limited to shall be in accordance with **SCHEDULE-V** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.

5.4.4. **Bus Bar Protection and Local Breaker Backup Protection (breaker failure protection):**

- i) Bus bar protection and local breaker backup protection shall be provided in 220 kV and higher voltage interconnecting sub- stations as well as in all generating station switchyards.
- ii) Duplication of bus bar protection shall be done for all main buses of 400kV and above voltage class.
- iii) The bus bar protection scheme shall be centralized or distributed type and have provision for planned future expansion.

5.5. HVDC Terminals/ Stations

5.5.1. Classical HVDC Terminals/ Stations

- i) HVDC system protection shall consist of two parts:

(A) AC side protection:

AC side protection function shall cover the zone for converter transformer, AC filters, shunt capacitors, shunt reactors, and bus bars. These protections shall generally follow the same philosophy as in a typical substation i.e. detection of fault by relay and tripping of circuit breaker.

(B) DC side protection:

DC side protection shall cover the zones consisting of the valve hall, DC switchyard including smoothing reactor and DC filters, DC line, DMR line / electrode line and ground electrode. The protection equipment shall be designed to be fail safe and shall ensure high security to avoid mal-operation/ unwanted shutdown due to protection equipment failures.

- ii) Following a DC Line fault, the HVDC System shall have the facility to restart, one or more times, the faulted pole at a variable pre-selected DC voltage level(s), not below 80% of the nominal voltage rating. The DC transmission system shall be capable of recovery in a controlled and stable manner without commutation failures during recovery following ac and dc system faults. The post fault power order shall be equal to the pre-fault power order unless AC/ DC systems dictate otherwise.
- iii) Protection system required in respect of Classical HVDC Terminals/ Stations but not limited to shall be in accordance with 13 (b) of Part A of **SCHEDULE-VI** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.
- iv) Software based controls and protection shall be used to permit flexibility in effecting modifications. Protection and controls shall be duplicated for reliability. The control & protection shall provide fast controllability of the HVDC system.

5.5.2. Voltage Source Converter (VSC) based HVDC Terminals/Stations

- i) The protection equipment shall be designed to be fail-safe and shall ensure high security to avoid mal-operation/ unwanted shutdown due to protection equipment failures.
- ii) Protection system required in respect of Voltage Source Converter (VSC) based HVDC Terminals/ Stations but not limited to shall be in accordance with 8 (b) of Part B of **SCHEDULE-VI** of CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date.
- iii) Software based controls and protection shall be used to permit flexibility in effecting modifications. Protection and controls shall be duplicated for

reliability. Protection shall be provided by numerical relays to suit the requirement of the HVDC system.

5.6. Philosophy of Transmission Line Protection

5.6.1.

Sl. No.	Zone	Direction	Protected Line Reach Settings	Time Settings (in Seconds)	Remarks
1	Zone-1	Forward	80%	Instantaneous (0)	As per CEA
2a	Zone-2	Forward	For single ckt- 120 % of the protected line	0.5 to 0.6 - if Z2 reach overreaches the 50% of the next shortest line ; 0.35- otherwise	As per CEA
			For double ckt- 150 % of the protected line		As per CEA
2b	Zone-2 (for 220 kV and below voltage Transmission lines of utilities)	Forward	120 % of the protected line, or 100% of the protected line + 50% of the adjacent shortest line	0.35	As per CEA with minor changes
3	Zone-3	Forward	120 % of the (Protected line + Next longest line)	0.8 - 1.0	As per CEA
4	Zone-4	Reverse	10%- for long lines (for line length of 100 km and above) 20%- for shot lines (for line length of less than 100 km)	0.5 (Where Busbar Protection is not available: 0.25)	As per CEA

Note:

- 1) Zone-2:- Z2 Reach should not encroach the next lower voltage level.
- 2) Zone-3:- If Z3 reach encroaches in next voltage level (after considering “in-feed”), then Z3 time must be coordinated with the fault clearing time of remote end transformer.
- 3) Zone-4:- If utility uses carrier blocking scheme, then the Z4 reach may be increased as per the requirement. It should cover the LBB of local bus bar and should be coordinated with Z2 time of the all other lines.
- 4) The above settings are recommended primarily (exclusively) for uncompensated lines.

5.6.2.

<p>Lines with Series and other compensations in the vicinity of Substation</p>	<ul style="list-style-type: none"> • Zone-1: 80% of the protected line with 100ms-time delay. POR Communication scheme logic is modified such that relay trips instantaneously in Zone-1 on carrier receive. • Zone-2: 120 % of uncompensated line impedance for single circuit line. For Double circuit line, settings
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	<p>may be decided on basis of dynamic study in view of zero sequence mutual coupling.</p> <ul style="list-style-type: none"> Phase locked voltage memory is used to cope with the voltage inversion. Alternatively, an intentional time delay may be applied to overcome directionality problems related to voltage inversion. over-voltage stage-I setting for series compensated double circuit lines may be kept higher than 113%.
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5.6.3.

	Power Swing Blocking	<p>For all lines, block tripping in all zones except zone-1.</p> <p>Out of Step tripping to be applied on all inter regional tie lines. Deblock time delay = 2s</p>
	Protection for broken conductor	<p>Negative Sequence current to Positive Sequence current ratio more than 0.2 (i.e. $I_2/I_1 \geq 0.2$)</p> <p>Only for alarm: Time delay = 3-5 sec</p>
	Switch on to fault (SOTF)	<p>Switch on to fault (SOTF) function to be provided in distance relay to take care of line energization on fault</p>
	VT fuse fail detection function	<p>VT fuse fail detection function shall be correctly set to block the distance function operation on VT fuse failure.</p>
	Carrier Protection	<p>To be applied on all 220kV and above lines with the only exception of radial feeders.</p>
	Back up Protection	<p>On 220kV and above lines with 2 Main Protections:</p> <ul style="list-style-type: none"> Back up Earth Fault protections alone to be provided. No Over current protection to be applied.

		At 132kV and below lines with only one Main protection: <ul style="list-style-type: none"> • Back up protection by IDMT O/C and E/F to be applied.

5.6.4. Overvoltage Protection:

FOR 765kV LINES:	Low set stage (Stage-I): 106% - 109% (typically 108%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds.
400kV LINES/CABLE:	Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds.
FOR 220 KV LINES:	No over-voltage protection shall be used in general. If necessary, may be enabled on case-to-case basis after due approval from SLDC/ERLDC.
FOR 220 KV CABLE:	Low set stage (Stage-I): 110% - 112% (typically 110%) with a time delay of 5 seconds. High set stage (Stage-II): 140% - 150% with a time delay of 100 milliseconds.

- The lines emanating from same substation shall be provided with pick-up as well as time grading to avoid concurrent trippings. Grading to be done in such a way that inter-regional lines and lines with generation evacuation should trip last, as far as practicable.
- The overvoltage relay shall have better than 98% drop-off to pick-up ratio.
- To achieve required discrimination for OVR grading on account of limitation imposed by voltage resolution of the relay, Ph-to-Ph voltage to be used for Over Voltage detection.

5.6.5. Resistive Reach Setting

Setting for Phase-earth fault:

- a. Calculation of minimum load impedance shall be as per Ramkrishna Committee Recommendations.
- b. Maximum load current (I_{max}) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the minimum of the bay equipment individual rating) whichever is lower. Minimum voltage (V_{min}) to be considered as 0.85pu (85%).
- c. Minimum setting for resistive reach shall be such that it must cover fault resistance, arc resistance and the tower footing resistance.
- d. In general, maximum reach setting shall be 80% of the minimum load impedance.
- e. Utility should try to set Resistive reach setting < 4.5 times the zone reactive reach setting, however if there is any limitation from relay manufacturer's side then recommendation of OEM may be followed for maximum resistive reach setting.

Resistive reach shall be the maximum of the value determined by the above rules.

Setting for Phase-Phase fault:

- a. Calculation of minimum load impedance as per the method mentioned above for phase earth fault.
- b. Minimum setting for resistive reach shall be such that it must cover fault resistance and arc resistance.
- c. In general, the resistive reach of zone-3 is set less than 80% of minimum load impedance. For power swing consideration, a margin of DR is given. Therefore, it is essential that load should not encroach this DR. In view of this, R3ph-R4ph may be set 60% of minimum load impedance. R2ph and R1ph may be set 80% of R3ph-R4ph respectively.
- d. Utility should try to set Resistive reach setting < 3 times the zone reactive reach setting, however if there is any limitation from relay manufacturer's side then recommendation of OEM may be followed for maximum resistive reach setting.

Resistive reach shall be the maximum of the value determined by the above rules.

- e. For underground cable, as the fault mechanism and earthing resistance of sheath are different from tower footing resistance of overhead lines, the resistive reach setting of cable may be set as per OEM recommendation. However, effort shall be made to keep the setting within the above-mentioned range as far as possible honoring OEM guidelines.

5.6.6. Auto Reclosing:

The single-phase high-speed auto-reclosure (HSAR) at 220 kV level and above (except for the composite feeders: overhead plus underground) shall be implemented, including on lines emanating from generating stations. If 3-phase auto reclosure is adopted in the application of the same on lines emanating from generating stations should be studied and decision to be taken on case to case basis.

i) Scheme Special Requirements:

- a) Modern numerical relays (IEDs) have AR function as built-in feature. However, standalone AR relay or AR function of Bay control unit (BCU) for 220kV and above voltage lines may be used. For 132kV/110kV lines, AR functions built-in Main distance relay IED can be used.
- b) Fast simultaneous tripping of the breakers at both ends of a faulty line is essential for successful auto-reclosing. Therefore, availability of protection signalling equipment is a pre-requisite.
- c) Starting and Blocking of Auto-reclose Relays:

Some protections start auto-reclosing and others block. Protections which start A/R are Main-I and Main-II line protections. Protections which block A/R are:

- i. Breaker Fail Relay
- ii. Line Reactor Protections
- iii. O/V Protection
- iv. Received Direct Transfer trip signals
- v. Busbar Protection
- vi. Zone 2/3 of Distance Protection
- vii. Carrier Fail Conditions
- viii. Circuit Breaker Problems.
- ix. Phase to Phase Distance Trip
- x. AR selection switch in OFF position
- xi. Logic AR OFF in SAS
- xii. Phase Distance Start (when Auto reclosure is in progress)

When a reclosing relay receives start and block A/R impulse simultaneously, block signal dominates. Similarly, if it receives 'start' for 1-phase fault immediately followed by multi-phase fault the later one dominates over the previous one.

ii) **Requirement for Multi breaker Arrangement:**

Following schemes shall be adhered to multi-breaker arrangements of one and half breaker or double breaker arrangement:

- a) In a multi-Circuit Breaker (C.B.) arrangement one C.B. can be taken out of operation and the line still be kept in service. After a line fault only those CBs which were closed before the fault shall be reclosed.
- b) In multi-C.B. arrangement it is desirable to have a priority arrangement so as to avoid closing of both the breakers in case of a permanent fault.
- c) A natural priority is that the C.B. near the busbar is reclosed first. In case of faults on two lines on both sides of a tie C.B. the tie C.B. is reclosed after the outer C.Bs. The outer C.Bs. do not need a prioritizing with respect to each other.

iii) **Setting Criteria:**

- a) Auto reclosing requires a dead time which exceeds the de-ionising time. The circuit voltage is the factor having the predominating influence on the de-ionising time. Single phase dead time of 1.0 sec. is recommended for 765 kV, 400 kV and 220 kV system. For the lines emanating from generating stations single-phase dead time upto 1.5 sec may be adopted.
- b) According to IEC 62271-101, a breaker must be capable of withstanding the following operating cycle with full rated breaking current:

O - 0.3 s - CO - 3 min - CO

O stands for Open

CO stands for Close-Open

The rated operating cycle of the circuit breaker consisting of an opening, a holding time of 0.3 seconds, a CO cycle, a 3-minute wait, and another CO cycle.

The recommended operating cycle at 765kV, 400 kV and 220 kV is as per the IEC standard. Therefore, reclaim time of 25 Sec. is recommended.

5.7. Transmission Relay Loadability

Transmission Relay Loadability means the loading permitted in the transmission line by the relay including a security margin. The relay loadability is to be arrived in such a way as far as possible not to interfere with system operator actions, while allowing for short-term overloads, with sufficient margin to allow for inaccuracies in the relays and instrument transformers. Transmission relay do not prematurely trip the transmission elements out-of-service and allow the system operators from taking controlled actions consciously to alleviate the overload.

5.7.1. Protective relay settings shall

- i) Not limit transmission loadability;

- ii) Not interfere with system operators' ability to take remedial action to protect system reliability and;
- iii) Be set to reliably detect all fault conditions and protect the electrical network from the faults.

5.7.2. The protective functions which could trip with or without time delay, on load current i.e. load responsive phase protection systems including but not limited to:

- i) Phase distance.
- ii) Out-of-step tripping.
- iii) Switch-on-to-fault.
- iv) Overcurrent relays.
- v) Communications aided protection schemes including but not limited to:
 - Permissive overreach transfer trip (POTT).
 - Permissive under-reach transfer trip (PUTT).
 - Directional comparison blocking (DCB).
 - Directional comparison unblocking (DCUB).
- vi) Phase overcurrent supervisory elements (i.e., phase fault detectors) associated with current based, communication-assisted schemes (i.e., pilot wire, phase comparison, and line current differential) where the scheme is capable of tripping for loss of communications.

5.7.3. Each Transmission Licensee and Generating Company shall use any one of the following criteria for any specific circuit terminal to prevent its phase protective relay settings from limiting transmission system loadability while maintaining reliable protection of the Grid for all fault conditions. Relay loadability at 0.85 per unit voltage and a power factor angle of 30 degrees shall be evaluated.

- i) For Distance protection relays of transmission lines, the Zone-3 shall prevent load encroachment, considering the following criteria:
 - a) Maximum load current (I_{max}) may be considered as 1.5 times the thermal rating of the line or 1.5 times the associated bay equipment current rating (the Minimum of the bay equipment individual rating) whichever is lower.

(The rating considered is approximately 15 minutes rating of the Transmission facility).
 - b) For setting angle for load blinder, a value of 30 degree may be adequate in most cases.
 - c) The Distance protection relays shall have provision for load blinder characteristic or load encroachment detection.
- ii) For Directional Overcurrent relays, wherever used in a transmission line (132/110 kV level), the following shall be adopted:

- a) An overload alarm shall be set at 110% of the thermal rating of the line with sufficient delay. This alarm shall allow the operator to take corrective action.
- b) The Directional Overcurrent relay shall allow the line to carry 1.2 times of the thermal rating of the associated line or bay equipment (whichever is lower) at least 10 minutes.
- iii) For transformer protection relays the following shall be adopted:
 - Set the definite time transformer overload relay at 105% of the transformer ratings with sufficient delay. It shall be wired for alarm purpose only to allow the operator to take corrective action. No tripping shall be issued from this relay.
 - The back-up overcurrent relays shall use IDMT characteristics and be suitably coordinated with the upstream transmission network.
 - Install supervision for the transformer using either a top oil or simulated winding hot spot temperature element. The alarm and trip settings for these relays shall be set by individual entities based on the manufacturer's recommendation.

Thermal ratings as specified in the prevailing CEA's Manual on Transmission Planning Criterion shall be used for above requirement.

6. Protection Settings & Coordination

The purpose is to ensure system protection is coordinated among the grid connected entities. The Protection systems coordination comprises the following:

- i) Each Transmission Licensee, Load Dispatch Centre (LDC) and Generating Company shall keep themselves familiarized with the purpose and limitations of Protection System schemes applied in its area of control.
- ii) Each Transmission licensee shall coordinate its Protection System schemes with concerned transmission system, sub-transmission system and generators.
- iii) Each Generating Company shall coordinate its Protection System schemes with concerned transmission system and station auxiliaries.
- iv) Each Transmission Licensee and Generation Company shall be responsible for settings calculations for protection of elements under its ownership. It shall be the responsibility of the respective asset owner to obtain the inputs (adjacent line settings, infeed values etc.) from STU/Generating Company/ Transmission Licensee necessary for calculation of the settings.
- v) STU/Generating Company/Transmission Licensee shall provide the infeed values/latest network model to the requesting entity, within 15 days of receipt of such a request from the entity.
- vi) Each Generating Company and Transmission Licensee, for voltage levels 400kV and above and interstate lines, shall submit the protection settings as per the format

prescribed, along with the calculation sheets, co-ordination study reports and input data, in advance, to ERPC/ERLDC for every new element to be commissioned. The mentioned information shall be submitted to the ERPC/ERLDC two months in advance for all the elements proposed to be commissioned. ERPC shall furnish the approved settings within forty days from the date of submission of the settings by the entity.

- vii) The PCC of ERPC shall review the settings to ensure that they are properly coordinated with adjacent system and comply with the existing guidelines. The onus to prove the correctness of the calculated settings shall lie with the respective Transmission licensee/Generation Company. In case, the PCC feels that the adjacent transmission system settings need to be changed, in view of the new element, it shall inform the concerned entity for revision of the existing settings.
- viii) The PCC of ERPC shall review and approve the settings based on the inputs /report submitted by the entities.
- ix) The approved settings shall be implemented by the entity and proper record of the implemented settings shall be kept. The modern numerical relays have several settings for various features available in the relay. It shall be ensured that only the approved features and settings are enabled in the relay. No additional protection/setting shall be enabled without the prior approval of ERPC.
- x) Each Transmission licensee and Generating Company shall co-ordinate the protection of its station auxiliaries to ensure that the auxiliaries are not interrupted during transient voltage decay.
- xi) Any change in the existing protection settings, for voltage levels 400kV and above & interstate lines, shall be carried out only after prior approval from the ERPC. The owner entity shall inform all the adjacent entities about the change being carried out.
- xii) In case of failure of a protective relay or equipment failure, the Generating Company and Transmission Licensee shall inform appropriate SLDC/ERLDC/ERPC. The Generating Company and Transmission Licensee shall take corrective action as soon as possible.
- xiii) Each Transmission Licensee shall coordinate Protection Systems on major transmission lines and interconnections with neighbouring Generating Company, Transmission Licensee and appropriate LDC.
- xiv) ERPC in consultation with the ERLDC & Eastern Regional entities shall undertake review of the protection settings, assess the requirement of revisions in protection settings and revise protection settings, from time to time and at least once in a year. The necessary studies in this regard shall be carried out by the ERPC. The modifications/changes, if any, in protection settings shall be advised to the respective users and STUs.
- xv) ERPC shall maintain a centralized database and update the same on periodic basis in respect of their respective region containing details of relay settings for grid elements connected to 220 kV and above. ERLDC also shall maintain such database.

Respective Transmission licensee/Generating Company/Entities are responsible for ensuring to make available the implemented protection settings in the centralized database within fifteen days from the date of commissioning.

- xvi) If System Protection Schemes (SPS) is recommended to be implemented by the appropriate forum/Sub-Committee of ERPC on account of operational & system constraints, the same shall be implemented by the concerned Transmission licensee/Generating Company/Entities within the specified timelines.

7. Disturbance Monitoring, Analysis and Reporting

The Purpose is to ensure that adequate disturbance data is available to facilitate Grid event analysis. The analysis of power system disturbances is an important function that monitors the performance of protection system, which can provide information related to correct behavior of the system, adoption of safe operating limits, isolation of incipient faults,

7.1. The Disturbance Monitoring Requirements include the following:

- i) Each Transmission Licensee and Generating Company shall provide Sequence of Event (SOE) recording capability by installing Sequence of Event recorders or as part of another device, such as a Supervisory Control and Data Acquisition (SCADA) Remote Terminal Unit (RTU), a generator plants Digital (or Distributed) Control System (DCS) or part of Fault recording equipment.

This capability shall be provided at all substations and at locations to record all the events in accordance with CEA Grid Standard Regulations, 2010 amended to date. The following shall also be monitored at each location:

- a) Transmission and Generator circuit breaker positions
 - b) Protective Relay tripping for all Protection Groups that operate to trip circuit breakers identified in (a) above.
 - c) Tele protection keying and receive
- ii) In either case, a separate work station PC shall be identified to function as the event logger front end. The event logger work-station PC should be connected to UPS (Uninterrupted Power Supply).

The event logger signals shall include but not limited to

- All Circuit Breaker and isolator switching Operations
- Auxiliary supply (AC, DC and DG) supervision alarms
- Auxiliary supply switching signals
- Fire-fighting system operation alarms
- Operation signals (Alarm/Trip from all the protection relays.)
- Communication Channel Supervision Signals.
- Intertrip signals receipt and send.
- Global Positioning System (GPS) Clock healthiness.

- Control Switching Device healthiness (if applicable).
 - RTU/Gateway PC healthiness
 - All Circuit Breaker Supervision Signals.
 - Trip Circuit Supervision Signals.
- iii) Each Transmission Licensee/Generating Company/Users shall provide Disturbance recording capability for the following Elements at facilities:
- All transmission lines (Each line shall be provided with facility for distance to fault locator)
 - Autotransformers or phase-shifters connected to busses.
 - Shunt capacitors, shunt reactors.
 - Individual generator line interconnections.
 - Dynamic VAR Devices.
 - HVDC terminals.
 - Bus Bars
- iv) The Disturbance recording feature shall be enabled and configured in all the numerical relays installed. Disturbance recording system shall have minimum recording time of 3 seconds (0.5 seconds for pre-fault and 2.5 seconds for post fault).
- v) Each Generating Company shall provide Disturbance recording capability for Generating Plants in accordance with Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 amended to date, the CEA (Technical Standards for connectivity to the Grid) Regulations 2007 amended to date.
- vi) Each Transmission Licensee and Generating Company shall record for Faults, sufficient electrical quantities for each monitored Element to determine the following:
- Three phase-to-neutral voltages. (Common bus-side/line side voltages may be used for lines.)
 - Three phase currents and neutral currents.
 - Polarizing currents and voltages, if used (As applicable).
 - Frequency (As applicable).
 - Real and reactive power (As applicable).

The Minimum parameters to be monitored in the Fault record is given at Annexure.

- vii) Each Transmission Licensee and Generating Company shall provide Disturbance recording with the following capabilities:
- The Disturbance recorders shall have time synchronization and a standard format for recording analogue and digital signals (DR labels to be standardized

as per the Report of FOLD Working Group - 3 on DR Parameter Standardization). The data files shall be capable of being viewed, read, and analyzed with a generic COMTRADE analysis tool as per the latest revision of IEEE Standard C37.111.

- Each Fault record duration and the trigger timing shall be settable and set for a minimum 3 second duration including 0.5 seconds for pre-fault and 2.5 seconds for post fault
 - Each Fault recorder shall have sampling frequency of 1 kHz or better.
 - Each Fault recorder shall be set to trigger for at least the following:
Internal protection trip signals, external trigger input and additional triggers may be assigned as necessary.
- viii) Each Transmission Licensee and Generating Company shall keep the recording instruments (disturbance recorder and event logger) in proper working condition and shall establish a maintenance and testing program for Disturbance Recorder (DR) that includes
- Maintenance and testing intervals and their basis.
 - Summary of maintenance and testing procedures.
 - Monthly verification of communication channels used for accessing records remotely (if the entity relies on remote access and the channel is not monitored to a control centre staffed around the clock, 24 hours a day, 7 days a week (24/7)).
 - Monthly verification of time synchronization (if the loss of time synchronization is not monitored to a 24/7 control centre).
 - Monthly verification of active analog quantities.
 - A requirement to return failed units to service within 90 days. If a Disturbance Recorder (DR) will be out of service for greater than 90 days, the Transmission Licensee and Generating Company shall keep a record of efforts aimed at restoring the DR to service.
- ix) The time synchronization of the disturbance recorders shall be corroborated with the PMU data or SCADA event loggers by ERLDC. ERLDC shall list out for Disturbance recorders which are non-compliant for discussion in PCC meetings of ERPC.
- x) Each Transmission Licensee and Generating Company shall submit the data files to the ERLDC conforming to the following format requirements:
- The data files shall be submitted in COMTRADE and PDF format.
 - File shall have contained the name of the Relay, name of the Bay, station name, date, time resolved to milliseconds, event point name, status.

The DR archives shall be retained for a period of three years.

xi) A separate work-station PC, powered through UPS (Uninterrupted Power Supply) shall be identified with access to all the relays for extraction of DR. Auto-Download facility shall be established for automatic extraction of the DR files to a location on the work- station PC.

xii) **Time Synchronization Equipment**

- a) Time Synchronizing Equipment complete with antenna, all cables and processing equipment shall be provided to receive synchronizing pulse through Global Positioning System or Indian Regional Navigation Satellite System Navic compatible for synchronization of event logger, disturbance recorder, Phasor Measurement Units, and Supervisory Control and Data Acquisition System or Substation Automation System.
- b) Each substation shall have time synch equipment to synchronize all the numerical relays installed. Before any extension work, the capability of the existing Time-sync equipment shall be reviewed to ensure the synchronization of upcoming numerical relays.
- c) The status of healthiness of the time-sync device shall be wired as “Alarm” to SCADA and as an “Event” to Event Logger.
- d) The time synch status of all the installed numerical relays and event logger shall be monitored monthly and recorded. The Monthly records for relays not in time-sync shall be reported to ERLDC and ERPC. This record shall be archived for a period of three years by each concerned agency.
- e) Remedial action shall be taken by the concerned substation/ Protection department immediately to make the relays in time synchronization with reference to external time source.
- f) All the new Grid elements/Bay extension shall have accurate and precise Time synchronization equipment.

7.2. Disturbance Analysis and Reporting

- i) Immediately following an event (grid disturbance or grid incidence as defined in the CEA Grid Standards) in the system, the concerned user or SLDC shall inform ERLDC through voice message.
- ii) Written flash report shall be submitted to ERLDC and appropriate SLDC by the concerned Transmission Licensee/Generating Company/User within eight (8) hours from Grid event.
- iii) Disturbance Recorder (DR), station Event Logger (EL), Data Acquisition System (DAS) shall be submitted by the respective Transmission licensee and Generating Company within twenty-four (24) hours from Grid event. These records shall be uploaded by the respective Transmission licensee and Generating Company in the Web Based Tripping Portal of ERLDC.
- iv) ERLDC shall classify the grid incidents and grid disturbances according to CEA (Grid Standards) Regulations, amended to date. ERLDC shall report the event (grid

disturbance or grid incidence) to CEA, ERPC and all regional entities within twenty-four (24) hours of receipt of the flash report.

- v) After a complete analysis of the event, the Transmission licensee and Generating Company/User shall submit a detailed report in the case of grid disturbance or grid incidence within one (1) week of the occurrence of event to ERLDC and ERPC.
- vi) ERLDC shall prepare a draft report of each grid disturbance or grid incidence including simulation results and analysis which shall be discussed and finalized in the PCC meetings of ERPC as per the timeline specified in Table below.

Sl. No	Grid Event (GD/GI Classification as per the CEA Grid Standards)	Flash report submission deadline (Users/SLDC)	Disturbance record and station event log submission deadline by Users/SLDC)	Detailed report and data submission deadline by Users/SLDC)	Draft report submission deadline by ERLDC	Discussion in PCC and final report submission deadline by ERPC
1	GI-1/GI-2	8 hours	24 hours	+7 days	+7 days	+60 days
2	Near miss event	8 hours	24 hours	+7 days	+7 days	+60 days
3	GD-1	8 hours	24 hours	+7 days	+7 days	+60 days
4	GD-2/GD-3	8 hours	24 hours	+7 days	+21 days	+60 days
5	GD-4/GD-5	8 hours	24 hours	+7 days	+30 days	+60 days

vii) The analysis reports submitted by ERLDC shall be discussed in the Protection Coordination Sub-Committee (PCC) meetings of the ERPC. The PCC shall identify the lessons learnt during the events being discussed. The PCC shall scrutinize the correctness of operation of subject protection systems put in place by the concerned Constituents and the final analysis report along with the recommendations shall be concluded. It shall also recommend the appropriate remedial measures for system improvement.

viii) The implementation of the recommendations of the final report shall be monitored by the PCC of ERPC.

ix) Any additional data such as

- Single line diagram (SLD)
- Protection relay settings,
- HVDC transient fault record,
- Location of fault with distance
- Fault details with type & relay indications
- CT/PT/CVT rating details with location
- Bus-bar arrangement/ Configuration of feeders
- CB positions (OPEN/ CLOSE) at the time of fault

- Isolator & Earth-switch positions (OPEN/CLOSE)
- Voltage, frequency & power flows with direction at the time of fault
- DR&EL records
- switchyard equipment

and any other relevant station data required for carrying out analysis of an event by ERPC, ERLDC and concerned SLDC shall be furnished by the Users including ERLDC and respective SLDC, as the case may be, within forty- eight (48) hours of the request. All Users shall also furnish high-resolution analog data from various instruments including power electronic devices like HVDC, FACTS, renewable generation (inverter level or WTG level) on the request of ERPCs, NLDC, ERLDCs or SLDCs.

- x) Triggering of STATCOM, TCSC, HVDC run-back, HVDC power oscillation damping, generating station power system stabilizer and any other controller system during any event in the grid shall be reported to the ERLDC and ERPC if connected to ISTS and to the concerned SLDC if connected to an intra-state system. The transient fault records and event logger data shall be submitted to the ERLDC or concerned SLDC within 24 hours of the occurrence of the incident. Generating stations shall submit 1 second resolution active power and reactive power data recorded during oscillations to ERLDC or concerned SLDC within 24 hours of the occurrence of the oscillations.
- xi) A monthly report on events of unintended operation or non-operation of the protection system shall be prepared and submitted by each user/owner of important elements in the regional grid, as identified by the appropriate forum of ERPC including those in the State grids that are critical for regional grid operation to ERPC and ERLDC within the first week of the subsequent month.
- xii) The detailed analysis reports shall be archived periodically. The archive shall be retained for a period of three years by each concerned agency.

8. Protection Audit Plan

- i) All Users/Entities connected at 220 kV and above, shall conduct internal audit, as per the prescribed audit checklist, of their protection systems annually, and any shortcomings identified shall be rectified and informed to ERPC. The audit report along with action plan for rectification of deficiencies detected, if any, shall be shared with ERPC.
- ii) All Users /Entities shall also conduct third party protection audit of each sub-station at 220 kV and above once in five years.
- iii) After analysis of any event, PCC of ERPC may identify a list of substations / and generating stations where third-party protection audit is required to be carried out and accordingly advise the respective users to complete third party audit within three months.
- iv) The third party audit report shall contain all the information as in *Annexure-1(Third*

Party Protection System Checking & Validation Template for a Substation) of CERC (Indian Electricity Grid Code), Regulations 2023). The protection audit reports, along with action plan for rectification of deficiencies detected, if any, shall be submitted to the respective ERPC and ERLDC or respective SLDC, as the case may be, within a month of submission of third party audit report. The necessary compliance to such protection audit report shall be followed up regularly in the PCC meetings of ERPC.

- v) ERPC shall keep all compliance monitoring reports/audit reports at least for five years.
- vi) Annual audit plan for the next financial year shall be submitted by the Users/entities to ERPC by 31st October of every year. The users shall adhere to the annual audit plan and report compliance of the same to ERPC.

9. Performance Monitoring of the Protection Systems

9.1. Users/Entities shall submit the following protection performance indices of previous month to ERPC and ERLDC on monthly basis for 220 kV and above by 15th of the subsequent month and the same shall be reviewed in the ensuing PCC meeting of ERPC.

- a) The Dependability Index defined as $D = N_c / (N_c + N_f)$

Where, N_c is the number of correct operations at internal power system faults and N_f is the number of failures to operate at internal power system faults.

- b) The Security Index defined as $S = N_c / (N_c + N_u)$

Where, N_c is the number of correct operations at internal power system faults and N_u is the number of unwanted operations.

- c) The Reliability Index defined as

$$R = N_c / (N_c + N_i)$$

Where, N_c is the number of correct operations at internal power system faults and N_i is the number of incorrect operations and is the sum of N_f and N_u

9.2. Users/Entities shall furnish the reasons for performance indices less than unity of individual element wise protection system to the ERPC and action plan for corrective measures. The action plan will be followed up regularly in the PCC Meetings.

10. Compliance Monitoring

10.1. The Protection Protocol of ER shall be reviewed as and when required, in consultation with the stakeholders of the Eastern Region.

10.2. Violation of the Protection Protocol of the Eastern Region shall be brought to the notice of ERPC by the ERLDC or concerned SLDC, as the case may be.

10.3. In case any User/Entity fails to comply with the Protection Protocol or fails to undertake remedial action identified by the PCC of ERPC within the specified timelines, the ERPC would approach the Commission with all relevant details for suitable directions.

ANNEXURE - 1

THIRD PARTY PROTECTION SYSTEM CHECKING & VALIDATION TEMPLATE FOR A SUBSTATION

1. INTRODUCTION

- (1) The audit reports, along with action plan for rectification of deficiencies found, if any, shall be submitted to RPC or RLDC within a month of submission of report by auditor.
- (2) The third-party protection system checking shall be carried at site by the designated agency. The agency shall furnish two reports:
 - (a) Preliminary Report: This report shall be prepared on the site and shall be signed by all the parties present.
 - (b) Detailed Report: This report shall be furnished by agency within one month after carrying out detailed analysis.

2. CHECKLIST

- (1) The protection system checklist shall contain information as per this Regulation.
 - (a) General Information (to be provided prior to the checking as well as to be included in final report):
 - (i) Substation name
 - (ii) Name of Owner Utility
 - (iii) Voltage Level (s) or highest voltage level?
 - (iv) Short circuit current rating of all equipment (for all voltage level)
 - (v) Date of commissioning of the substation
 - (vi) Checking and validation date
 - (vii) Record of previous tripping's (in last one year) and details of protection operation
 - (viii) Previous Relay Test Reports

- (ix) Overall single line diagram (SLD)
- (x) AC aux SLD
- (xi) DC aux SLD
- (xii) SAS architecture diagram
- (xiii) SPS scheme implemented (if any)

(b) The preliminary report shall inter-alia contain the following:

TABLE A: FORMAT OF PRELIMINARY REPORT

S. No.	Issues	Remarks
1	Recommendation of last protection checking and validation	Status of works and pending issues if any
2	Review of existing settings at substation	Recommended Action
3	Disturbance Recorder out available for last 6 tripping's (Y/N)	Recommended Action
4	Chronic reason of tripping, if any	Recommended Action
5	Major non-conformity/deficiency observed	Recommended Action

(c) The relay configuration checklist for available power system elements at station:

- (i) Transmission Line
- (ii) Bus Reactor/Line Reactor
- (iii) Inter-connecting Transformer
- (iv) Busbar Protection Relay
- (v) AC auxiliary system
- (vi) DC auxiliary system
- (vii) Communication system
- (viii) Circuit Breaker Details

- (ix) Current Transformer Details
 - (x) Capacitive Voltage Transformers Details
 - (xi) Any other equipment/system relevant for protection system operation
- (d) The minimum set of points on which checking and validation shall be carried out is covered in this clause. The detailed list shall be prepared by checking and validation team in consultation with concerned entity, RLDC and RPC.
- (i) Transmission Line Distance Protection/Differential Protection
 - a. Name and Length of Line
 - b. Whether series compensated or not
 - c. Mode of communication used (PLCC/OPGW)
 - d. Relay Make and Model for Main-I and Main-II
 - e. List of all active protections & settings
 - f. Carrier aided scheme if any
 - g. Status of Power Swing/Out of Step/SOTF/Breaker Failure/Broken Conductor/STUB/Fault Locator/DR/VT fuse fail/Overvoltage Protection/Trip Circuit supervision/Auto-reclose/Load encroachment etc.
 - h. Relay connected to Trip Coil-1 or 2 or both
 - i. CT ratio and PT ratio
 - j. Feed from DC supply-1 or 2
 - k. Connected to dedicated CT core (mention name)
 - l. Other requirements for protection checking and validation
 - (ii) Shunt Reactor & Inter-connecting Transformer Protection
 - a. Whether two groups of protections used (Group A and Group B)
 - b. Do the groups have separate DC sources
-

- c. Relay Make and Model
- d. List of all active protections along with settings
- e. Status of Differential Protection/Restricted Earth Fault Protection/Back-up Directional Overcurrent/Backup Earth fault/ Breaker Failure
- f. Status of Oil Temperature Indicator/Winding Temperature Indicator/Bucholz/Pressure Release Device etc.
- g. Relay connected to Trip Coil-1 or 2 or both
- h. CT ratio and PT ratio
- i. Feed from DC supply-1 or 2
- j. Connected to dedicated CT core (mention name)
- k. Other requirements for protection checking and validation

(iii) Busbar Protection Relay

- a. Busbar and redundant relay make and model
- b. Type of Busbar arrangement
- c. Zones
- d. Dedicated CT core for each busbar protection (Yes/No)
- e. Breaker Failure relay included (Yes/No), if additional then furnish make and model
- f. Trip issued to both Busbar protection in case of enabling
- g. Isolator indication and check relays
- h. Other requirements for protection checking and validation

(iv) AC auxiliary system

- a. Source of AC auxiliary system

- b. Supply changeover between sources (Auto/Manual)
 - c. Diesel generator (DG) details
 - d. Maintenance plan and supply changeover periodicity in DG
 - e. Single Line Diagram
 - f. Other requirements for protection checking and validation
- (v) DC auxiliary system
- a. Type of Batteries (Make, vintage, model)
 - b. Status of battery Charger
 - c. Measured voltage (positive to earth and negative to earth)
 - d. Availability of ground fault detectors
 - e. Protection relays and trip circuits with independent DC sources
 - f. Other requirements for protection checking and validation
 - g. Communication system
 - i. Mode of communication for Main-1 and Main-2 protection
 - ii. Mode of communication for data and speech communication
 - iii. Status of PLCC channels
 - iv. Time synchronization equipment details
 - v. 7OPGW on geographically diversified paths for Main-1 and main-2 relay
 - vi. Other requirements for protection checking and validation
- (vi) Circuit Breaker Details
- a. Details and Status
 - b. Healthiness of Tripping Coil and Trip circuit supervision relay
 - c. Single Pole/Multi pole operation
-

- d. Pole Discrepancy Relay available(Y/N)
- e. Monitoring Devices for checking the dielectric medium
- f. Other requirements for protection checking and validation

(vii) Current Transformer (CT)/Capacitive Voltage Transformer (CVT) Details

- a. CT/CVT ID name and voltage level
- b. CT/CVT core connection details
- c. Accuracy Class
- d. Whether Protection/Metering
- e. CT/CVT ratio available and ratio adopted
- f. Details of last checking and validation of CT/CVT healthiness
- g. Other requirements for protection checking and validation
- h. Other protections: Direction earth fault, negative sequence, over current, over voltage, over frequency, under voltage, under frequency, forward power, reverse power, out of step/power swing, HVDC protection etc.

3. SUMMARY OF CHECKING:

The summary shall specifically mention minimum following points:

- (1) The settings and scheme adopted are in line with agreed protection philosophy or any accepted guidelines (e.g. Ramakrishna guidelines or CBIP manual based).
- (2) The deviations from the RPC protection philosophy, if any and reasons for taking the deviations shall be recorded.
- (3) All the major general deficiency shall be listed in detail along with remedial recommendations.

- (4) The relay settings to be adopted shall be validated with simulation based or EMTP studies and details shall be enclosed in report.
- (5) The cases of protection maloperation shall be analysed from protection indices report furnished by concerned utility, the causes of failure along with corrective actions and recommendations based on the findings shall be noted in the report.

SI No.	Name of the incidence	PCC Recommendation	Latest status
135th PCC Meeting			
1.	Disturbance at 220 kV Tenughat(TVNL) S/s on 18.04.2024 at 22:12 Hrs	<p>PCC advised TVNL that the testing of existing busbar relay may be done in consultation with the OEM and the present event may be referred to OEM for analysis and suggestion. As the implementation with numerical relay will take considerable time, the existing relay may be tested thoroughly and the problems may be rectified.</p> <p>PCC advised TVNL representative that they may take help of DVC for identifying and resolving the issues in existing busbar relay.</p> <p>On DR synchronization issue, TVNL intimated that the work order has been issued and the issue will be resolved by Aug-24. For Biharsharif end, BSPTCL representative replied that GPS clock is not working at Biharsharif end and regarding rectification of the same, they would update at the earliest.</p>	
2.	Disturbance at 220 kV Kasba (WBSETCL) S/s on 25.04.2024 at 23:17 Hrs	PCC advised that the overcurrent pick up setting may be increased to 110 % of CT ratio for these lines.	
3.	Total Power Failure at 220 kV Chatra (JUSNL) S/s on 06.04.2024 at 14:05 Hrs	<p>JUSNL was advised following:</p> <ul style="list-style-type: none"> ➤ Disturbance Recorders of all the relays at Chatra end may be reconfigured as per the PCC guidelines and compliance of the same shall be intimated to ERLDC/ERPC at the earliest. ➤ The relays at Chatra end may be tested for their healthiness in phased manner. ➤ Submit the event analysis report after site visit of CRITL team 	

4.	Total Power Failure at 220 kV Pratapsasan (OPTCL)S/s on 23.04.2024 at 14:22 Hrs	PCC opined that blocking of isolator and CB status should not cause busbar relay operation and suggested that this event of mal-operation of busbar relay shall be consulted with relay OEM and logic of busbar relay may be reviewed. PCC advised the issue may be resolved within a month.	
5.	Tripping of 220 Kv Bus-1 at Ramchandrapur on 02.04.2024 at 22:46	PCC advised JUSNL following: <ul style="list-style-type: none"> ➤ The overcurrent settings of bus coupler relay may be revised and some time delay may be kept instead of making it instantaneous. ➤ The rectification status of busbar & LBB protection at Ramchandrapur may be submitted. 	
6.	Islanding of CESC system	CESC representative replied that detailed report for each of the events will be shared to ERPC/ERLDC at earliest. ERLDC suggested to increase islanding criteria of undervoltage from 2 seconds to around 8 seconds. CESC representative replied that this issue of delayed recovery of undervoltage and its effect on islanding criteria is already being discussed internally and it will be revised after getting approval from higher authority.	
7.	Repeated Tripping of 400 kV Barh-Kahalgaon-1 without any fault	PCC opined that as this issue might get be repeated again so the procurement process must be expedited and replacement of cable and relay may be completed at the earliest at Kahalgaon end.	
8.	Repeated Tripping of 220 kV Darbhanga (DMTCL)-Darbhanga D/c	PCC advised following: <ul style="list-style-type: none"> ➤ As the lines are short, permissive overreach 	

		<p>scheme may be implemented with current reversal guard.</p> <p>➤ The DEF settings may be revised and for the directional element, negative sequence may be selected instead of zero sequence.</p>	
134th PCC Meeting			
9.	Bus tripping occurred in Eastern Region during March'24	<p>PCC advised BSPTCL representative to share last test report of failed CT to ERPC/ERLDC.</p> <p>PCC advised BSPTCL following:</p> <ul style="list-style-type: none"> • To review Protection settings of ICT • To test the relay of Laukahi-DMTCL line-1 • To test the bus bar protection and submit details by 23rd April 2024. • To segregate feeders on both bus in balanced way so that in case of one bus tripping, feeders on other bus can remain in charged condition. 	<p><i>BSPTCL representative informed that bus bar protection is not in operation at Laukahi S/s and issue had been intimated to higher authority for making bus bar protection operational at earliest.</i></p> <p><i>PCC advised to revise zone 4 time settings of the connected feeders at Laukahi to 250 ms till the time busbar is not available.</i></p> <p><i>BSPTCL representative informed that protection settings of ICT had not been reviewed till date and it is planned to be reviewed during internal audit.</i></p> <p><i>PCC advised BSPTCL representative to segregate feeders among both bus at Laukahi S/s.</i></p>
133rd PCC Meeting			
10.	Review of SPS at Sterlite (Vedanta)	<p>SLDC Odisha representative informed that the meeting to discuss the modalities of implementation of proposed SPS scheme will be convened within a week.</p>	<p><i>SLDC Odisha representative informed that Vedanta has sought some additional time for implementation of the SPS. PCC advised SLDC to coordinate with Vedanta</i></p>

			for early implementation of the SPS.
132nd PCC Meeting			
11.	Disturbance at 220 kV Biharsharif S/s on 14.01.2024	<ul style="list-style-type: none"> ➤ PCC advised Powergrid and BSPTCL to jointly review the highset overcurrent protection considering the present network configuration and fault level. ➤ PCC advised BSPTCL to review E/F setting of the ICTs as well as lines at 220 kV Biharsharif S/s ➤ DR configuration to be done by BSPTCL for the relays of ICT-1 & 2 and relays of Mokama lines. 	<p><i>In 133rd PCC, BSPTCL representative informed that Powergrid had been communicated to revise overcurrent settings at their end and settings at their end will be revised consequently. He further informed that shutdown of ICT 1 and 2 is applied for 18th March 2024 in order to rectify DR and other issues.</i></p> <p><i>BSPTCL representative informed that DR configuration had been rectified.</i></p> <p><i>Powergrid representative informed that review of setting is in progress and details will be shared with BSPTCL/ERLDC.</i></p>
130th PCC Meeting			
12.	Tripping of 220 kV Main Bus-2 at Budhipadar on 06.10.23 at 16:14 Hrs	<p>PCC advised to replace the defective bay unit at the earliest and restore the busbar protection for bus-2 thereafter.</p> <p><i>In 132nd PCC Meeting, OPTCL representative informed that OEM M/s Siemens had been communicated for this issue. He further informed that bus bar protection for bus 2 is in off condition and for bus 1 is in service at present.</i></p>	<p><i>In 133rd PCC, OPTCL representative informed that M/s Siemens had been communicated to submit estimate for procurement of new relay.</i></p> <p><i>OPTCL representative informed that offer price had been received from M/s Siemens and work order will be placed soon.</i></p>