भारत सरकार
Government of India
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
पश्चिम क्षेत्रीय विद्युत समिति
Western Regional Power Committee
एफ -3, एमआयडीसी क्षेत्र, अंधेरी (पूर्व), मुंबई - 400 093
F-3, MIDC Area, Andheri (East), Mumbai - 400 093
दूरभाष Phone: 022- 28250004, 28221681; 28200194; 28200195; फैक्स Fax : 022 – 28370193
Website : www.wrpc.gov.in E-mail : prc-wrpc@nic.in

आई एस ओ ः 9001-2008
ISO : 9001-2008

संख्या : पक्षेविस /रक्षण/ पीसीएम / कार्यवृत्त /2019/ 6351 दिनांक : 31.05.2019
No. : WRPC/Protection/PCM/Minutes/2019/ Date: 31.05.2019

सेवा में / To

As per List (सूची के अनुसार)

विषय : 136 वीं रक्षण समिति की बैठक की कार्यवृत्त।
Sub : Minutes of the 136th Protection Committee Meeting.

महोदय / Sir,

इस पत्र के साथ दिनांक **17।05।2019** को 10:30 बजे, कान्फ्रेंस हाल, प. क्षे. वि. स , एमआइडीसी मरोल, अंधेरी पूर्व, मुंबई में संपन्न हुई रक्षण समिति की **136** वीं बैठक की कार्यवृत्त संलग्न है।

Please find enclosed herewith Minutes of the 136th Protection Committee Meeting of WRPC held on 17.05.2019 at 10:30 Hrs at Conference Hall, WRPC, MIDC Marol, Andheri (E), Mumbai-400 093. **It is to be noted that the Minutes of the above meeting is also available on website www.wrpc.gov.in in news and Meetings section.**

भवदीय / Yours' faithfully,

(J K Rathod)
अधीक्षण अभियंता (रक्षण) / Superintending Engineer (Protection)

Mailing list:

1 Chief Engineer (LD), MSETCL, Kalwa. Fax-27601769/65
2 Chief Engr. (Trans O&M), MSETCL, Bandra. Fax No. 022 - 26590808/26598587.
3 CE (W), MSEGCL, 3rd floor, Prakash gad, Mumbai.
4 S.E. (T&C), MSETCL, Aurangabad Fax-0240-2234220 /2346290
5 S.E (T&C), MSETCL, Pune. Fax-9520-2617532/2612342
6 Dy. CE (Testing), MSETCL, Koradi, Nagpur. Fax- 07109 - 262162
7 S.E.(T&C), MSETCL, Vashi Fax- 022-27656039 /27653463
8 S.E.(Testing), Bhusawal, Dist: Jalgaon Fax-02582-250379
9 S.E.(TCC), MSETCL, Karad. Fax.No. 02164 255118
10 CE, SLDC, GETCO, Gotri, Vadodara
11 Chief Engineer (Gen), GSECL, H.O. Baroda. Fax-0265-5512129/2344537
12 S.E. (Testing), GETCO, Baroda. Fax-0265-2351218
13 Chief Engineer (LD), MPPTCL, Jabalpur, Fax - 0761- 2664343 / 2970119.
14 E.D. (T&C), MPPTCL, Jabalpur. Fax-0761-2702710
15 ED (Engg.) MPPGCL, Jabalpur Fax- 0761-2660063
16 Chief Engineer (LD), CSPTCL, Raipur. Fax-0771 - 2574174
17 C.E. (T&C), CSPTCL, Raipur.Fax-0771-2574749
18 EE (T), CSPGCL- Fax.No. 07789-226227
19 S.E. (T&C), CSPTCL, Bhilai. Fax.No. 0788 - 2281561
20 S.E. (T&C), CSPTCL, Raipur. Fax No.0771 – 2574749 / 2574458.
21 EE, Division VIII (MRT),Elect. Dept; Goa Fax 0832-2735124.
22 Supdt.Engr., Electricity Dept., DNH, Silvasa. Fax : 0260-2642338
23 Executive Engr., Electricity Dept. DD. Fax: 0260-2250889
24 D.G.M. (O.S.),N.T.P.C., Mumbai, Fax- 28216692
25 DGM, NTPC WR – II, Raipur, Fax: 0771 - 2544550
26 D.G.M. (EM), KSTPS, NTPC, Korba Fax 07759-233088 (Tele fax: 232440) /237462
27 DGM (EMD), VSTPS, NTPC, Vindhyachal Fax-07805-247713 /247711
28 DGM (EM-I), NTPC, SIPAT Fax-07752-246506 (Tele fax: 246691)
29 AGM (O&M), KGPP, Adityanagar, Surat Fax 0261-2861428/2861433
30 Sr. Supdt. (EM), Gandhar, NTPC Fax-02642-87402 / 87450
31 DGM (O.S.), WRLDC, Mumbai Fax-28235434
32 DGM, WRTS-I, PGCIL, Nagpur, Fax- 0712- 2631051 / 641366
33 AGM, WRTS-II, PGCIL, Baroda Fax-0265-2480952 (Tele fax: 2487542)
34 AGM, O&M, WRTS – III, PGCIL, Raipur. Fax: 0771 - 2970450
35 SME (E), TAPS-3&4,Tarapur Fax 02525-282001/282073
36 Maintenance Superintendant, TAPS –1 & 2, Tarapur.Fax- 02525-282121
37 SME(E), NPCIL , Kakrapara Fax 02626-234266
38 GM (Maint.). TORRENT Power., Ahmedabad.Fax-079-27506679
39 AGM (QAIT), TPC, Trombay. Fax –022-66687088
40 Asst. VP, Dahanu TPS Fax- 952528-222576 / 222039
41 GM (O & M), Reliance Infrastructure Limited, Mumbai Fax-30094488
42 GM (Electrical), JPL, Raigarh, Fax. No. 7767-281995, 281993.
43 AGM (OS), NSPCL, New Delhi . Fax.No.011 26717381/26717363/26717366
44 Vice President, APL, Ahmedabad 079-25557176
45 GM, RGPPL, Anjanwel, Guhagar, Ratnagiri, Fax.No. 02359 241071
46 GM, JSW Energy Ltd., Jindal Mansion, Mumbai- Fax.No.022 23526400
47 GM, CGPL, Mundra Fax.No. 02838 661188
48 VP, EPTCL, Hazira, Surat, Gujarat Fax: 0261 – 6682747
49 Director (CM Division), CEA,New Delhi, Fax No. 011-26109750
50 Director (NPC), CEA, Katwaria Sarai, New Delhi

Minutes of the 136th Protection Sub-Committee Meeting (PCM) of WRPC was held on 17.05.2019 at WRPC Mumbai.

The 136th meeting of Protection sub-Committee was held on 17th May, 2019 at WRPC Mumbai. The list of participants enclosed at **Annexure-A**.

Member Secretary (MS), WRPC welcomed all the participants of the 136th PCM. He informed that occurrences for the period from January to April 2019 will be discussed in this meeting (136th PCM). He informed the following:

- A meeting was held on 24.04.2019 at WRPC Mumbai to discuss Islanding scheme for Kakrapar Atomic Power Project (KAPP – 3 & 4), 2x700 MW capacity Nuclear Power Units of NPCIL.
- More number of incidents happened from January to April 2019 and but most of the constituents did not submit DR/EL reports within 24 hours of the event and detailed analysis report, SLD to WRPC/WRLDC.
- The last PCM (i.e. 135th) was held in the month of February 2019. The frequency of PCM meetings is required to be increased so as to discuss the events without long delay otherwise the seriousness in analyzing/ discussing the old disturbances is lost.
- All the constituents were requested to submit the incident reports i.e DR/EL, SLD of substation indicating CT, PT, fault locations, CB on/off status, detailed analysis report to WRPC/WRLDC regularly.
- Next WRPC meeting (38th) will be held in the month of June 2019.
- CERC would be convening a meeting with RPCs to discuss various issues. Constituents were requested to submit any protection related issues for discussion with CERC.
- Relay setting data base is in progress at WRPC. Generators were requested to send the relay setting details of their plants to WRPC by mail at the earliest.
- Many constituents have not submitted data for CERC compliance and Enquiry committee recommendations to NPC/CEA and requested them to submit the required data at the earliest to WRPC.

After his opening remarks, the agenda items were taken up for discussions.

Item No. 1: Confirmation of Minutes of the 135th PCM

The 135th meeting of protection sub-committee was held on 20th February 2019 at WRPC Mumbai. The Minutes of Meeting (MoM) was circulated vide letter WRPC/Protection/ PCM/Minutes/2019/2924 dated 12.03.2019.

No comments were received on the MoM.

The sub-Committee confirmed the MoM of the 135th PCM without modification.

Item No. 2: Grid Incidences (GI)/Grid Disturbances (GD)

Covering GD/GI incidences took place during 01.01.2019 to 30.04.2019 (Categorization of grid incidents and grid disturbance as per CEA (Grid Standard regulations), 2010 is enclosed as annexure I)

2A. Gujarat system

2A.1.	**Substation:**	**400/220 kV Veluda**
	Date & time:	**07.01.2019 at 10:13 hrs.**
	Event Category:	**GI-2**

2A.1.1 Event Summary:

- On 07.01.2019 at 10.13 hrs there was a grid incidence at 400/220 kV Veluda s/s .
- At 400/220 kV Veluda s/s, pipe bus from R phase isolator of 400 kV Veluda-Vadavi line dropped down from isolator toward its line CT resulted in tripping of all the elements connected to 400 kV Bus 1 on Busbar protection operation.
- Tripping's observed are as follows:

1.400/220 kV 500 MVA Veloda ICT-1
2.400 kV Veluda-Vadavi
3.400 kV Veluda-Charanka 1
4.400 kV Veluda-Banaskantha 1
5.400 kV Veluda-Banaskantha 2

SLD/Event report is enclosed as **Annexure 2A.1**.

2A.1.2: Discussion in 136th PCM

GETCO representative gave a brief on the disturbance as follows;

- At 400/220 kV Veluda s/s, 400 KV bus bar protection was operated with Bus-A, R-Ph differential protection at 10.12.51 hrs because of 400 KV R-Ph Pipe bus of 400 KV Veluda-Vadavi line dropped down from Isolator Clamp (Toward 400 KV Line CT side) and earthed with PI structure.

- Which resulted in tripping of all 400kv Lines, 400/220KV ICT No-1 and 400 KV bus coupler which were connected with 400 KV Bus-A tripped at 400 KV Veluda ss.
- 400 kv bus position of the 400 KV feeders / ICTs were as under at the time of occurrence:

400 KV Bus-A	**400 KV Bus-B**
1. 400/220kv 500MVA ICT-1	1. 400/220kv 500MVA ICT-2
2. 400kv Veluda-Vadavi Line	2. 400kv Veluda-Kansari Line
3. 400kv Veluda-Charanka Line-1	3. 400kv Veluda-Charanka Line-2
4. 400kv Veluda-Banaskantha Line-1	4. 400kv Bus Coupler
5. 400kv Veluda-Banaskantha Line-2	5. 400kv,80MVAR Bus Reactor
6. 400kv Bus Coupler (Bkr Off condition)	

400kv TBC Bus
400kv TBC Bay is not connected with 400kv Bus-A or 400kv Bus-B.

Sequences of occurrence of the events during the incident are as follows:

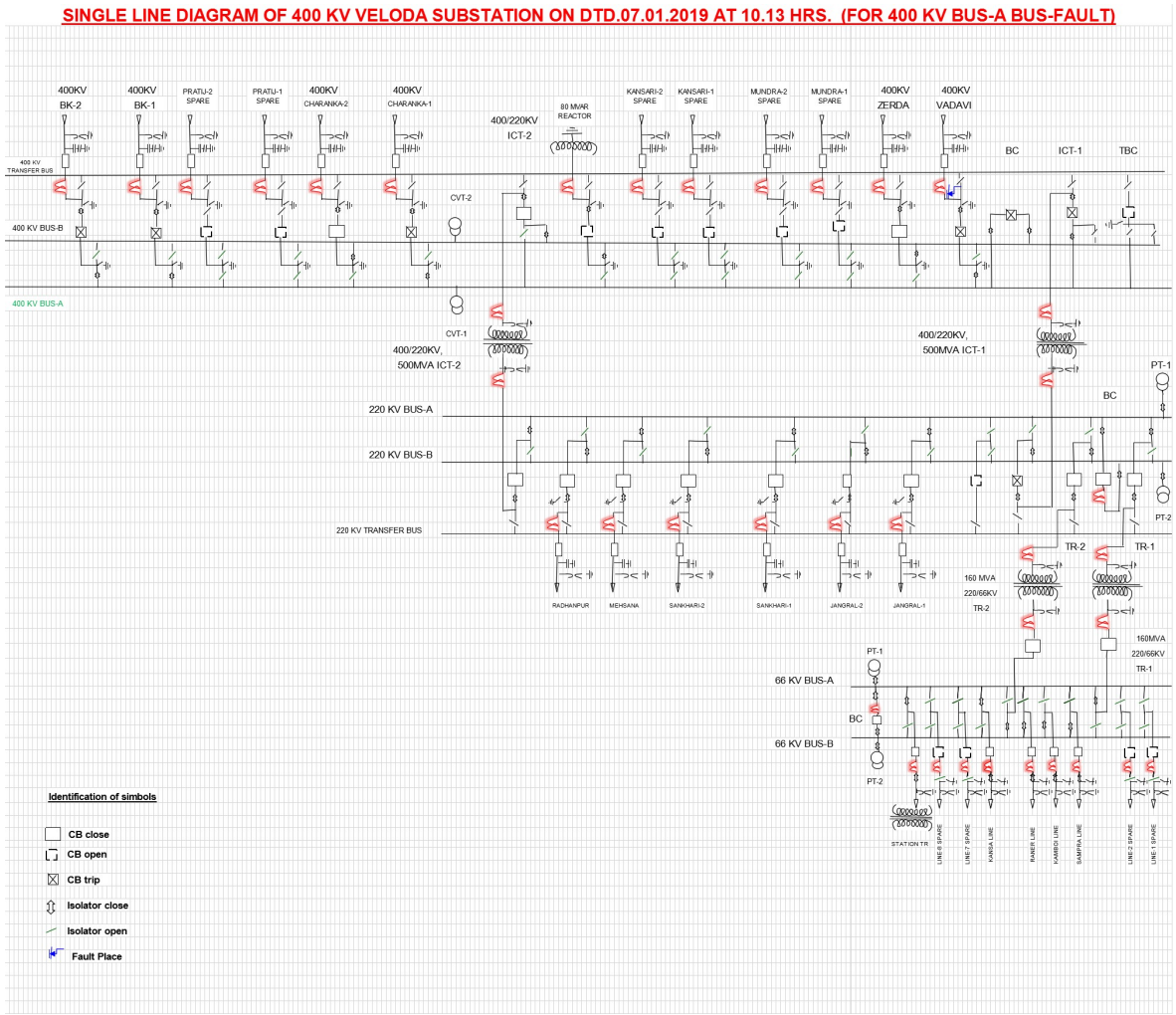
- 400kv bus bar protection operated with Bus-A R-Ph differential protection at 10.12.51Hrs because of 400kv R-ph Pipe bus of 400kv Veluda-Vadavi Line dropped down from Bus –C Isolator Clamp (Toward 400kv Line CT side) and Earthed with PI structure and All 400kv Lines, 400/220KV ICT No-1 and 400kv BC which were connected with 400kv Bus-A tripped at 400kv Veluda ss end.
- Opposite end of all 400kv Lines which were connected with Bus-A tripped with DT received.
- LV side of 400/220kv ICT-01 was tripped with (HV side -96X LV Inter tripped relay) inter tripped relay
- Zone -2 start and Carrier send by M2 relay (POTT) from 400kv Vadavi ss to 400kv Veluda ss in 400KV Vadavi-Veluda line.

Tripping of elements with relay Indications are as follows:

SN	**Name of Bay**	**Veluda end**	**Opposite end**
1	400kv BB Protection CU (400kv Veluda)	Diff Bus-A Tripped R-Ph, Check zone Op. Diff R-Ph :-1147.5 A Bias R-Ph BUS-1:- 1379.53 A (Max Fault Current:- Diff R-Ph 4.4KA, Bias R-Ph 7.5KA)	

2	400/220kv 500MVA ICT-1 (HV Side)	H.V Side In BB PU:- Bus-A 96X relay(LV tripping)	LV side Inter tripped
3	400 KV Veluda-Vadavi Line	In BB PU:- Bus-A R-PH BB Diff Fault Current R-ph :-4.45KA In M1 & M2 Relay:- BB OP, DT Send	DT received 86A and 86B OP In M2 relay:- Carrier Send
4	400kv Veluda-Charanka Line-1	In BB PU:- Bus-A In M1 & M2 Relay:- BB OP, DT Send	DT received 86A and 86B OP
5	400 KV Veluda-Banaskantha Line-1 (PGCL)	In BB PU:- Bus-A In Dist Relay:- BB OP, DT Send, 86 OP, DT received	DT received 86A and 86B OP
6	400kv Veluda-Banaskantha Line-2 (PGCL)	In BB PU:- Bus-A In DistRelay:- BB OP, DT Send	DT received 86A and 86B OP
7	400kv Bus Coupler	In BB PU:- Bus-A	

SLD of 400KV Veloda SS is given below:-



Resumption of elements after the incident are as follows:

SN	Name of Bay	From		To		Duration
		Date	Time	Date	Time	
01	400 kv Bus –A	07.01.19	10.12	07.01.19	11.10	0:58Hrs
02	400kv Bus Coupler	07.01.19	10.12	07.01.19	11.10	0:58Hrs
04	400/220kv ICT-1	07.01.19	10.12	07.01.19	11.15	1:03Hrs
05	400kv Veluda-Charanka Line-1	07.01.19	10.12	07.01.19	12.05	1:53Hrs
06	400kv Veluda-Banaskantha Line-1	07.01.19	10.12	07.01.19	12.52	2:40Hrs
07	400kv Veluda-Banaskantha Line-2	07.01.19	10.12	07.01.19	12.52	2:40Hrs
08	400kv Veluda-Vadavi Line	07.01.19	10.12	07.01.19	18.52	8.42Hrs

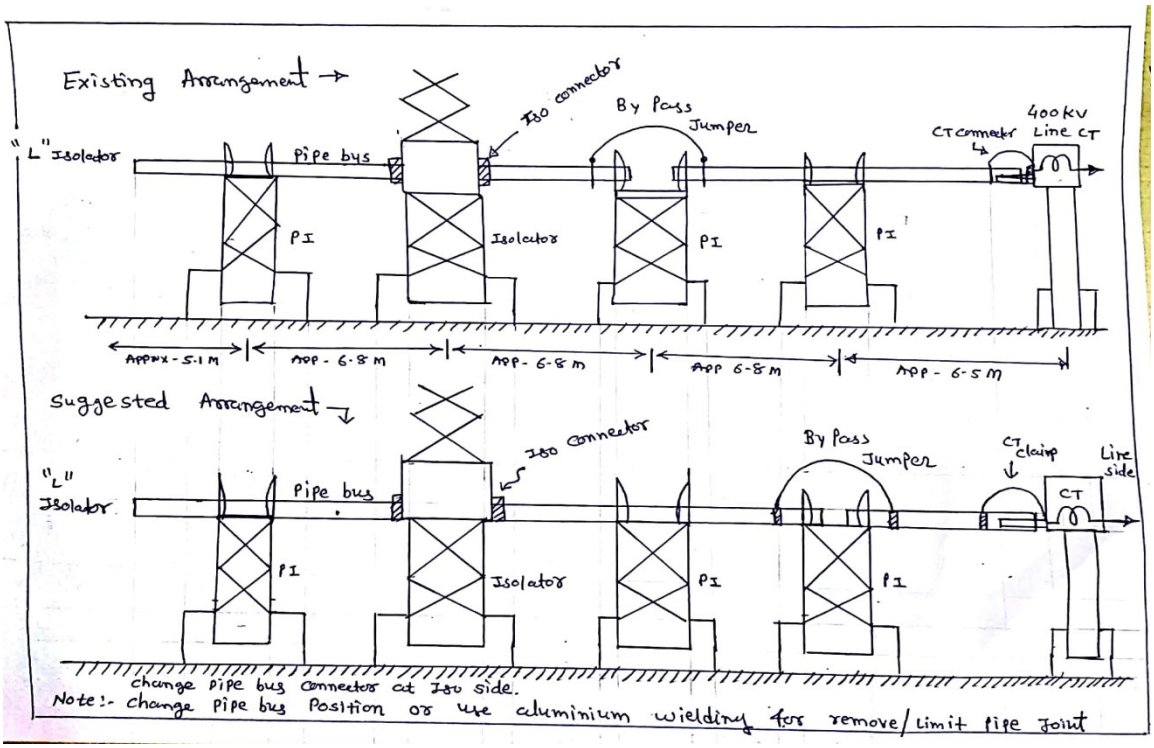
After the grid incident the action taken was as follows:

- During physical verification of 400kv switch yard, fault was found in 400kv Veluda-Vadavi line's bay. It was then isolated from 400kv Bus-A .400kv Bus-A was charged via 400kv Bus coupler bay at 11.10Hrs Dt-07.01.2019.
- 400/220kv,500MVA ICT-1 was charged from HV side and load taken at 11.15Hrs.
- 400kv Veluda-Charanka Line -1 was Charged and made paralleled at 12.05Hrs.
- 400kv Veluda-Banaskantha Line-1 and 2 was Charged from 400kv Veluda end at 12.52Hrs.
- 400kv Veluda-Vadavi Line was charged at 18.52hrs on 07.01.19 after replacing Pipe bus connecter of R-ph PI and 400kv pipe bus reconnect with 400kv "C" isolator.

Remedial measures taken after the incidence are as follows:

- Position of pipe clamp should be changed with some design also. Pipe bus should rest on L clamp of isolator clamp so that such type of reoccurrence can be avoided.Pl see the photographs of existing connection & pipe clamp.
- Minimization of pipe bus joints and if it is utmost necessary then arrange its position in such a way that joint should come on Bus PI as on bus PI there is another clamp for fixing of Pipe bus but Never allow joint on PI next to Isolator/CT(where in CT clamp, no long rod with flexible jumper is provided for fixing of Pipe bus).This creates chances

of reoccurrence. (only single joint is sufficient for pipe bus expansion in summer season/ampere loading for this much length).



Committee observed the following:

- MS enquired whether thermo vision scanning for hot spots was carried out on the substation equipment.
- GETCO representative informed that thermo vision scanning for hot spots was carried out on 08.12.2018 on the substation equipment but did not find any hot spots in and around the failed equipment. He further informed that it was a mechanical failure.
- Committee observed that 400kv bus bar protection operated with Bus-A R-Ph differential protection was because of 400kv R-ph Pipe bus of 400kv Veluda-Vadavi Line dropped down from Bus–C Isolator Clamp (Toward 400kv Line CT side) and Earthed with PI structure. All 400kv Lines, 400/220KV ICT No-1 and 400kv BC which were connected with 400kv Bus-A tripped at 400kv Veluda ss end.
- The operation of bus bar protection was found in order.

Committee suggested effective maintenance of sub-station equipment for reducing similar type of incidents in future.

2A.2.	**Substation:**	**400/220 kV Kasor**
	Date & time:	**15.01.2019 at 02:50 hrs.**
	Event Category:	GI-2

2A.2.1 : Event Summary:

- On 15.01.2019 at 02.50 hrs there was a grid incidence at 400/220 kV Kasor s/s.
- At 400/220 kV Kasor s/s, Kite string struck between R&B phase of 400 kV Bus 2.
- Both the buses(Bus 1&2) tripped during the event.
- Tripping's observed are as follows:

1.400 kV Kasor-SSP
2.400 kV Kasor-Rajgarh D/C
3.400 kV Kasor-Chorania
4.400 kV Kasor-GPEC
5.400 kV Kasor Bus Reactor 1&2
6.400 kV 315 MVA Kasor ICT 1&2
7.400 kV 500 MVA Kasor ICT 3

SLD/Event report is enclosed as **Annexure 2A.2**.

2A.2.2 : Discussion in 136th PCM

GETCO representative gave a brief on the disturbance as follows;

The bus position of the 400KV Lines / ICTs / Reactors at the time of occurrence was as under.

- 400KV Bus coupler breaker was "ON" at the time of occurrence.

400KV BUS A	**400KV BUS B**
1) 400KV Chorania Line	1) 400KV SSP Line
2) 400KV Rajgadh-2 Line	2) 400KV GPEC Line
3) 315MVA 400/220KV ICT-3	3) 400KV Rajgadh-1 Line
4) 50MVAr 400KV Bus Reactor	4) 315MVA 400/220KV ICT-1
	5) 315MVA 400/220KV ICT-2

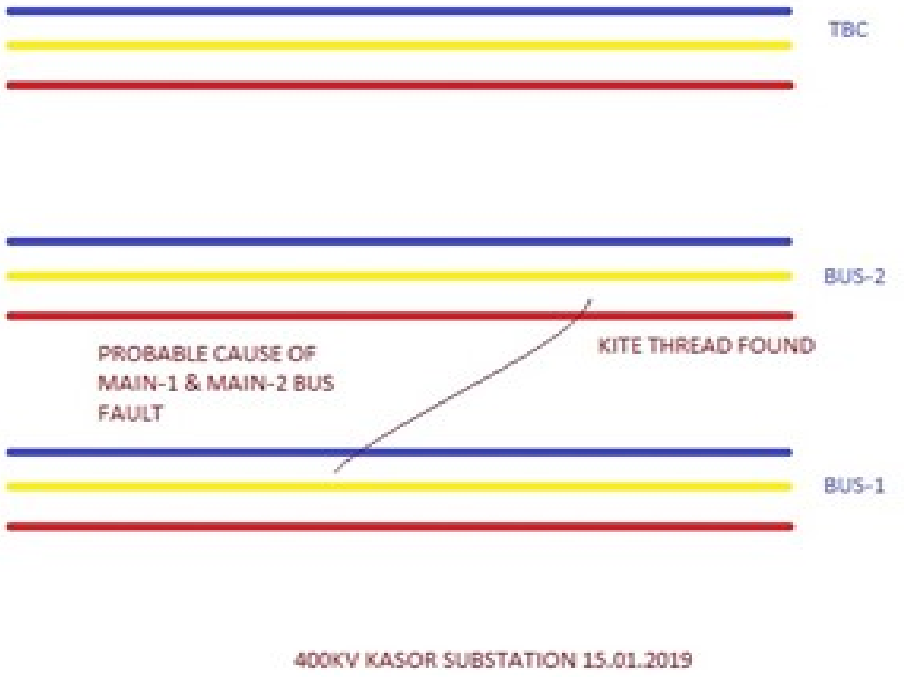
Sequences of occurrence of the events during the incident are as follows:

- On 15-01-2019 02:50 hrs, 400KV Bus bar Protection was operated and tripped both 400KV Main Bus-1 and 400KV Main Bus-2.
- All 400KV Bays which were connected to 400KV Main Bus-1 and 400KV Main Bus-2were tripped.
- During yard observation by substation staff, Kite Thread was recovered between 400KV Bus coupler bay and 50MVAr Reactor bay.

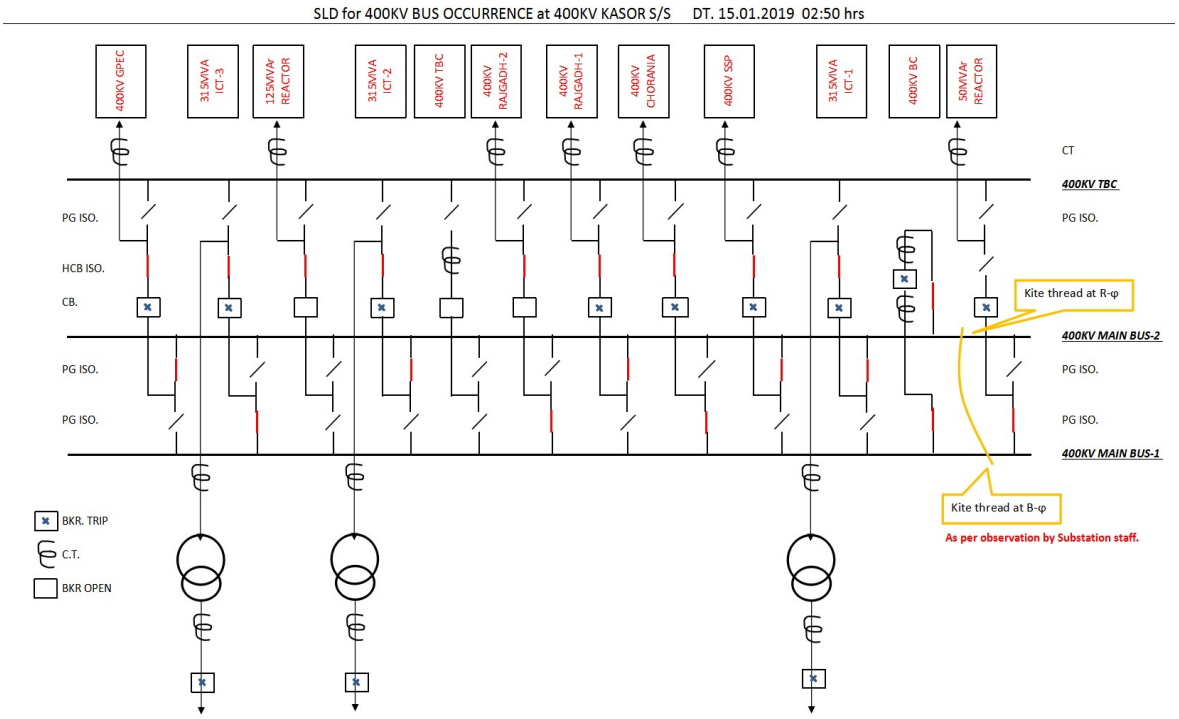
Tripping of elements with Relay indication at 400KV Kasor S/S are as follows:

SN	Name of Bay	Kasor End	Opposite End
1	400KV Bus Coupler	R & B - phase Trip, Z-1 & Z-2 Operated F/C - IA - 7.828KA, IB - 445.3Amp, IC - 3.852KA, IN - 11.24KA	NA
2	400KV Chorania	R & B - phase Trip, Z-1 & Z-2 Operated F/C - IA - 2.418KA, IB - 527.3Amp, IC - 2.922KA, IN - 42.97Amp	Breaker Trip, DT received, 86 Trip
3	400KV SSP	R & B - phase Trip, Z-1 & Z-2 Operated F/C - IA - 1.875KA, IB - 93.75Amp, IC - 1.953KA, IN - 0.0Amp	Breaker Trip, R & B phase Trip, 86A Trip, Dist. - 146km, F/C R phase - 2.257KA, B phase - 2.340KA; DT Received
4	400KV Rajgadh1	R & B - phase Trip, Z-1 & Z-2 Operated F/C - IA - 1.277KA, IB - 128.9Amp, IC - 1.371KA, IN - 35.16Amp	DT received
5	400KV Rajgadh2	HV OFF	HV OFF
6	400KV GPEC	R & B - phase Trip, Z-1 & Z-2 Operated F/C - IA - 2.684KA, IB - 406.3Amp, IC - 2.305KA, IN - 0.0Amp	Breaker Trip, R & B phase Trip, Z-1, Dist. - 107.9km, F/C IA - 4.115KA, IC - 3.707KA, 186A & 186B Optd., A/R L/O, DT Received
7	400KV 315MVA ICT-1	R & B - phase Trip, Z-1 & Z-2 Operated HV side : F/C - IA - 972.7Amp, IB - 109.4Amp, IC - 867.2Amp, IN - 0.0Amp LV side : F/C - 0.0Amp	Inter-Tripped by HV
8	400KV 315MVA ICT-2	R & B - phase Trip, Z-1 & Z-2 Operated HV side : F/C - IA - 910.2Amp, IB - 113.3Amp, IC - 855.5Amp, IN - 35.16Amp LV side : F/C - 0.0Amp	Inter-Tripped by HV
9	400KV 315MVA ICT-3	R & B - phase Trip HV side : F/C - IA - 1.070KA, IB - 117.2Amp, IC - 925.8Amp, IN - 46.88Amp LV side : F/C - 0.0Amp	Inter-Tripped by HV
10	400KV 50 MVAR Bus Reactor	R & B - phase Trip, Z-1 & Z-2 Operated F/C - IA - 71.29Amp, IB - 71.29Amp, IC - 68.36Amp, IN - 0.0Amp	NA
11	400KV 125 MVAR BUS REACTOR	P/F	

400KV Kasor SS 15.01.2019 SLD are as follows:



SLD for 400KV BUS OCCURRENCE at 400KV KASOR S/S is given below:-



Resumption of the 400KV Kasor SS elements are as follows:-

Sr.No.	Name of Substation	Name of Bay	From		To
			Date	Time (Hrs.)	Date
1	400kv Kasor	400kv Chorania	15.01.2019	02:50	15.01.2019
2	400kv Kasor	400kv SSP	15.01.2019	02:50	15.01.2019
3	400kv Kasor	400kv Rajgadh-1	15.01.2019	02:50	15.01.2019
4	400kv Kasor	400kv Rajgadh-2	15.01.2019	OFF	15.01.2019
5	400kv Kasor	400kv GPEC	15.01.2019	02:50	15.01.2019
6	400kv Kasor	315MVA ICT-1	15.01.2019	02:50	15.01.2019
7	400kv Kasor	315MVA ICT-2	15.01.2019	02:50	15.01.2019
8	400kv	315MVA	15.01.2019	02:50	15.01.2019

Committee observed the following:

- Kite string was found between 400 kV bus reactor and Bus coupler bay at Kasor substation, It is suspected that the Kite string found in switchyard was stuck between B phase of 400 kV Kasor Bus 1 and R phase of Kasor Bus 2, resulted in tripping of all the 400 kV elements on Kasor substation on 400 kV Bus1&2 Bus bar protection operation at 02:50 Hrs.
- As seen from the BB central unit DR, the fault was in R and B phase and the fault cleared in 49 ms. There was no load loss due to the event.
- From DR of 400KV Bus bar central unit, it was found that there was phase to phase fault between R-ϕ and B-ϕ of both 400KV Main Bus-1 and 400KV Main Bus-2. The maximum fault current of 19kA was recorded for R-ϕ and B-ϕ both.
- No abnormal Neutral current in Bus bar Central Unit DR was recorded.
- 400KV Bubar protection operated correctly and all Bays were isolated within 60 ms.
- The operation of bus bar protection was found in order.

Committee noted as above.

2A.3.	**Substation:**	**400/220 kV Veluda**
	Date & time:	**12.03.2019 at 18:03 hrs.**
	Event Category:	GI-2

2A.3.1 : Event Summary:

- On 12.03.2019 at 18.03 hrs there was a grid incidence at 400/220 kV Veluda s/s.
- 400 kV Veluda Bus 1 tripped on Bus bar protection operation due to fault in B phase CT pilot cable of 400kV Veluda-Charanka-1.

- Tripping's observed are as follows:

1.400/220 kV Veluda 500MVA ICT-1
2.400 kV Veluda-Vadavi Line
3.400 kV Veluda-Charanka 1
4.400 kV Veluda-Banaskantha 1

SLD/Event report is enclosed as **Annexure 2A.3**.

2A.3.2 : Discussion in 136th PCM

GETCO representative gave a brief on the disturbance as follows;

- At 400 KV Veluda , 400kv Bus-A on Bus bar protection operation. Which was due to 400 KV R-PH line CT secondary BB core found faulty (Core found Earth) and entered as a Spill CT secondary current in 400kv BB PU of 400 KV Veluda-Charanka Line-1 and that have operated BB.

400 kv bus position of the 400 KV feeders / ICTs were as under at the time of occurrence are as follows:

400 KV Bus-A	400 KV Bus-B
(1) 400/220kv 500MVA ICT-1	(1) 400/220kv 500M
(2) 400kv Veluda-Vadavi Line	(2) 400kv Veluda-Ka
(3) 400kv Veluda-Charanka Line-1	(3) 400kv Veluda-Cl
(4) 400kv Veluda-Banaskantha Line-1	(4) 400kv Bus Coup
(5) 400kv Bus Coupler	(5) 400kv,80MVAR I

400kv TBC Bus

(1) 400kv TBC Bay is not connected with 400kv Bus-A or 400kv Bus-B.

Sequence of occurrence of the event is as follows:

- 400kv Bus-B was charge through only 400KV Charanka-Varsana Line and 400kv Bus coupler breaker was off condition at 400kv Charanka ss end.
- 400kv Charanka-Varsana Line was made off by TNC at 400kv Varsana End at 18.03hrs due to this switch operation 400kv Bus-B voltage raised up to 530KV.
- Same time line fault was occurred on 400kv Charanka-Varsana Line and 400kv Breaker of said line tripped at 400kv Charanka ss end with Distance relay M1 and M2 operated and DT received (Distance M1 & M2 Operated with Relay :- B-Ph-E, Zone-1,Dist-54Km).

- Fault current was feeding through half open Bus –B panto Isolator of 400kv Charanka – Veluda Line-1 from 400kv Veluda ss system with breaking of air gap.
- At 400kv Veluada ss, at the same time, 400kv Bus-A tripped with R-ph Bus differential protection. All bays connected with 400kv Bus-A were tripped at 400kv Veluda ss and at Opposition end, all feeders were tripped with DT received and at Veloda, LV of 400kv ICT-1 was tripped with inter-tripping relay.

Tripping of elements at 400 KV Veluda S/S with Relay Indication are as follows:

SN	Name of Bay	Veluda end	Opposite end
1	400kv BB Protection CU (400kv Veluda ss)	Diff Bus-A Tripped R-Ph, Check zone Op. Diff R-Ph :-1.710KA Bias R-ph BUS-1:- 2.55 KA	
2	400/220kv 500MVA ICT-1 (HV Side)	H.V Side In BB PU:- Bus-A 96X relay(LV tripping)	LV side Inter tripped
3	400kv Veluda-Vadavi Line	In BB PU:- Bus-A R-PH BB Diff In M1 & M2 Relay:- BB OP, DT Send	DT received 86A and 86B OP In M2 relay:-Carrier Send
4	400kv Veluda-Charanka Line-1	In BB PU:- Bus-A In M1 & M2 Relay:- BB OP, DT Send	DT received 86A and 86B OP
5	400kv Veluda-Banaskantha Line-1 (PGCL)	In BB PU:- Bus-A In Dist Relay:- BB OP, DT Send,	DT received 86A and 86B OP
6	400kv Bus Coupler	In BB PU:- Bus-A,	

Action Taken after the incident as follows:-

- After DR verification, it was found that fault in R-Ph CT secondary circuit of 400kv Veluda-Charanka Line-1 and nothing found during physical verification of yard, 400kv Vadavi-Veluda Line charged at 14.35 hrs on dt-13.03.19.
- 400kv Bus-A charge from 400kv Vadavi-Veluda line at 14.37 hrs on 13.03.19
- 400kv Bus coupler breaker was made at 14.50hrs on 13.03.19 and both 400kv bus make parallel.

- 400/220kv, 500MVA ICT-1 was charged from HV side and load taken at 15.27hrs.
- 400kv Veluda-Banaskantha Line-1 was charged from 400kv Veluda ss end at15.33hrs.
- 400KV R-ph faulty CT replaced of 400kv Veluda-Charanka Line-1 by new one and after necessary testing, 400kv line was charged from 400kv Veluda ss end at 17.38hrs on dt-15.03.19.

After the incident resumption of elements are as follows:

SN	Name of Bay	From		To		Duration
		Date	Time	Date	Time	
01	400kv Veluda-Vadavi Line	12.03.19	18.03	13.03.19	14.35	20.32Hrs
02	400kv Bus -A	12.03.19	18.03	13.03.19	14.37	20.34Hrs
03	400kv Bus Coupler	12.03.19	18.03	13.03.19	14.50	20.47Hrs
04	400/220kv 500MVA ICT-1	12.03.19	18.03	13.03.19	15.27	21.24Hrs
05	400kv Veluda-Banaskantha Line-1	12.03.19	18.03	13.03.19	15.33	21.30Hrs
06	400kv Veluda-Charanka Line-1	12.03.19	18.03	15.03.19	17.38	71.35Hrs

Remedial measures suggested after the event are as follows:-

- Numerical BB protection Scheme should be developed in such a way that a Separate CT core being used for each i.e BB Check zone protection and BB main Zone protection so in any problem in CT's secondary circuit such type of mal operation of BB operation can be avoided.
- Numerical BB scheme should be modified in such a way that CU will cross check the fault current in all connected Feeder PU of that bus for through fault condition (means has not increase current) and at that time if in that bay PU(in which through fault exist) has noticed current in other phase and that current has a impact that this current has crossed bus differential current then in such case CU will give some alarm and will block the BB.
- All DR and reports are sent to GE for further analysis and concrete solution to meet such critical problem.

Committee observed the following:

- In 400kv Charanka-Veluda Line-1, distance relay M1 and M2 were observed pick up with Zone-3, B-ph to Earth Fault due to fault in 400kv Charanka-Varsana Line. 400kv Bus –A tripped with R-ph Bus differential at 400kv Veluda ss end with PU of 400kv Charanaka-Veloda line-1.

- During DR analysis, it was observed that fault current found in R-ph and B-ph in 400kv BB PU of 400kv Charanka-Veluda Line-1 which was connected CT core-04 and in same Line distance M1 and M2 relay which were connected CT core-1 and CT core-2 respectively indicated only B-ph fault current. Such type DR indicated that there was no any physical fault in 400kv Yard at 400kv Veluda ss but problem in secondary circuit of R-PH CT (Secondary pilot cable or CT secondary Core-4). During R-ph CT secondary testing, It was found that core-4 was Earthed so it was conclude that during B-ph fault some fault current may entered in R-ph CT secondary wiring in core-4(PU) and leading 400kv Bus-A differential operation with R-Ph.
- At 400kv Veluda ss, 400kv Bus-A was tripped with R-ph Bus bar differential Protection. Root cause of this was CT's core-4 earthed (Which use for BB Protection) and spill current found in R-Ph of Check zone protection and Main Zone protection of 400kv Bus bar protection system during B-Ph fault of Zone-3 of 400kv Veluda-Charanka Line-1 on dt-12.03.2019.

Committee observed that for the B phase external fault, R phase differential protection operated and the R phase differential current was found high. As reported by GETCO, R phase CT of the Charanka line was found faulty (Core 4 used for BB protection found earthed) and was replaced with a new one. It was observed that BB protection operation was a mal-operation due to the CT's core-4 earthing resulting into entering of spill current. Committee suggested that by proper maintenance of the substation equipment, these types of incidents can be avoided.

2A.4.	**Substation:**	**400 kV Kasor**
	Date & time:	**01.04.2019 at 08:58 hrs.**
	Event Category:	GI-2

2A.4.1 : Event Summary:

- On 01.04.2019 at 08.58 hrs there was a grid incidence at 400 kV Kasor s/s.
- At 400 kV Kasor s/s, B phase conductor from pantograph isolator broken and fell over the IPS tube of Y phase pantograph isolator of 400 kV Rajgadh 2.
- This created Y-B phase fault in 400 kV Kasor Bus1 and it tripped with all the elements connected on Bus bar protection operation.
- Tripping's observed are as follows:
  1. 400 kV Kasor- Rajgadh 2
  2. 400/220 kV 315MVA Kasor ICT 3
  3. 400 kV 50 MVAR Kasor Bus Reactor
  4. 400 kV Kasor Bus Coupler

SLD/Event report is enclosed as **Annexure 2A.4**.

2A.4.2 : Discussion in 136th PCM

GETCO representative gave a brief on the disturbance as follows;

The bus position of the 400KV Lines / ICTs / Reactors at the time of occurrence was as under.

- 400KV Bus coupler breaker was "ON" at the time of occurrence.

400KV BUS A

1. 400KV Rajgadh-2 Line
2. 315MVA 400/220KV ICT-3
3. 50MVAr 400KV Bus Reactor

400KV BUS B

1. 315 MVA 400/220 KV ICT-1
2. 400KV SSP Line
3. 400KV Chorania Line
4. 400KV Rajgadh-1 Line
5. 315MVA 400/220KV ICT-2

Sequence of occurrence of the event as follows:-

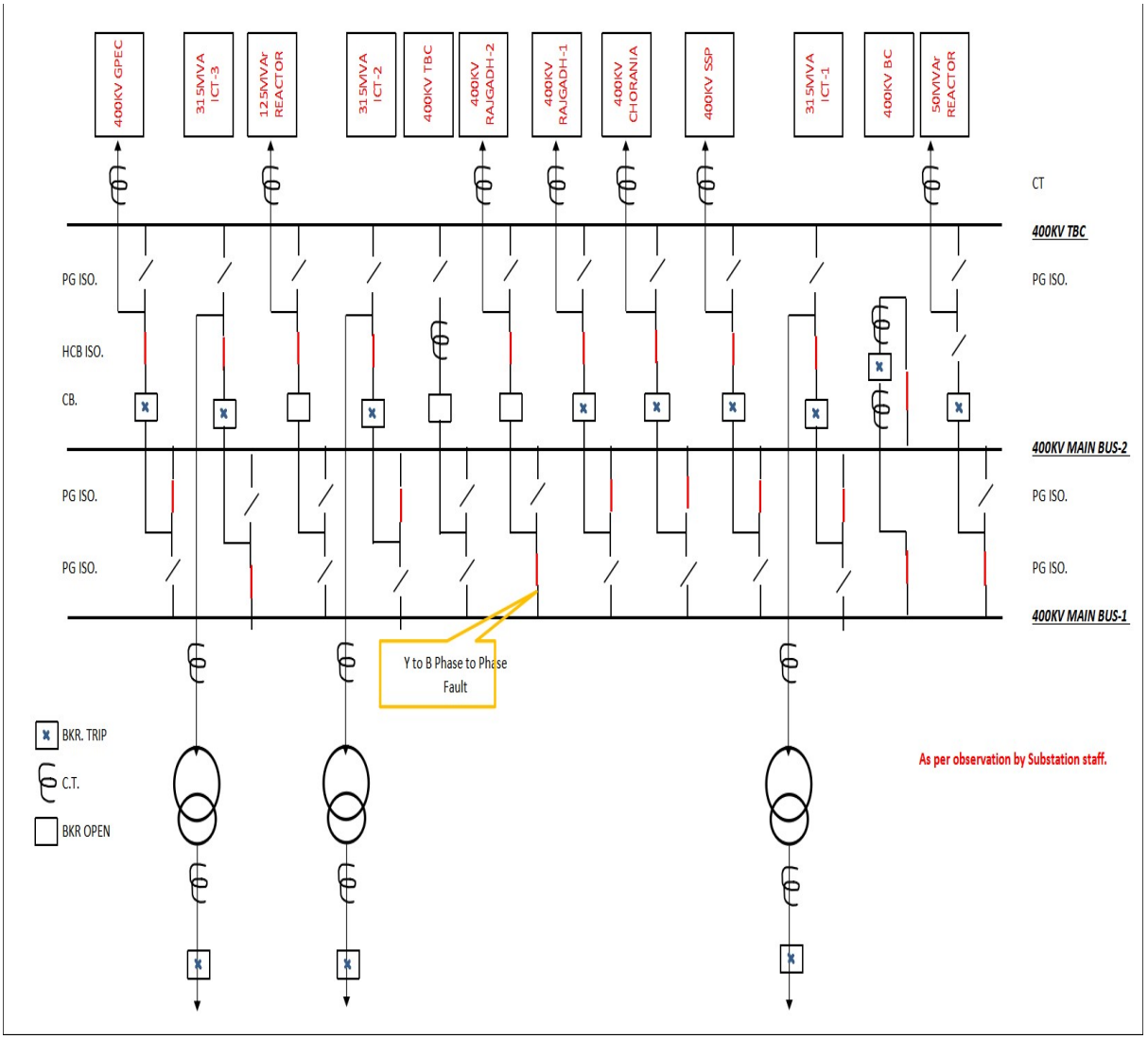
- 400KV Bus-1, B Phase Conductor from hanging contact of Bus 1 Pantograph of B Phase was Damaged and Broken and divided into two pieces. First broken Piece towards Gantry side (side 1 as per SLD), this piece of conductor fell down to IPS Pipe of Y Phase Pantograph Isolator of 400KV Rajgarh 2 Feeder, without touching the ground. And the second broken piece of conductor (side 2 as per SLD) remained on the hanging contact of Pantograph Isolator of B Phase.
- So, Y to B Phase to Phase fault without Ground occurred on Bus-1. So, following Bays on Bus-1 were tripped.
    1. 50 MVAR Bus Reactor.
    2. 400KV Rajgarh 2 Line.
    3. 315 MVA 400/220 KV ICT-3.
    4. 400KV Bus Coupler.
- Busbar Protection scheme Zone 1 Operated correctly and Bus 2 remained healthy.

Tripping of elements with Relay indication at 400KV Kasor S/S:

SN	Name of Bay	Kasor End	Opposite End
1	400KV Kasor-Rajgadh-2	**Busbar PU.** Y & B - phase, 87BB Z-1 Trip, F/C - IA - 515.6A, IB - 2.262KA, IC - 1.855KA, IN - 31.25Amp	DT received

2	400/220KV 315MVA ICT-3	**Busbar PU.** Y & B - phase, 87BB Z-1 Trip,, HV side : F/C - IA - 316.4A, IB - 1.965KA, IC - 2.188KA, IN - 85.94Amp LV side : F/C - F/C - IA - 379.3A, IB - 3.566KA, IC - 4.040KA, IN - 108.3Amp	LV Side Intertrip.
3	400KV 50 MVAR BUS REACTOR	**Busbar PU.** Y & B - phase, 87BB Z-1 Trip, F/C - IA - 68.36Amp, IB - 69.34Amp, IC - 68.36Amp, IN - 0.0Amp	NA
4	400KV Bus Coupler	**Busbar PU.** Y & B - phase, 87BB Z-1 Trip,, F/C - IA - 328.1A, IB - 19.14KA, IC - 19.43KA, IN - 105.5A	NA

SLD for 400KV BUS OCCURRENCE at 400KV KASOR S/S are as follows:-



The Isolator/CB closed status of Lines/Elements in 400KV Busbar Scheme at time of occurrence is as follows

ISO. Status in Busbar during Occurrence					
ELEMENT / LINE	**52CB [CB]**	**89A [Q1]**	**89B [Q2]**	**89C [Q3]**	**89L [Q4]**
400KV Bus Coupler	√	√	√		√
315MVA 400/220KV ICT-1	√		√		√
400KV SSP	√		√		√
400KV Chorania	√		√0		√
400KV Rajgadh-1	√	√			√
400KV Rajgadh-2	√		√		√
400KV TBC				√	√
315MVA 400/220KV ICT-2	√		√	1	√
50MVAr Bus Reactor		√	√		√
400KV GPEC	√		√		√
315MVA 400/220KV ICT-3	√	√			√

After the incident resumption of elements are as follows:

SN	Name of Substation	Name of Bay	From		To		Duration
			Date	Time (Hrs.)	Date	Time (Hrs.)	(Hrs.)
1	400kv Kasor	400kv Rajgadh-2	01.04.2019	08:58	02.04.2019	21:35	36:37
2	400kv Kasor	315MVA ICT-3	01.04.2019	08:58	01.04.2019	10:48	01:50
3	400kv Kasor	50 MVAr Bus Reactor	01.04.2019	08:58	02.04.2019	20:48	35:50
4	400kv Kasor	400KV Bus Coupler	01.04.2019	08:58	02.04.2019	20:38	35:40

Remedial measures taken after the event are as follows:-

Two no.s of damaged B-ph bus conductor above 400KV Rajgadg-2 bay were replaced and 400KV Main Bus-1 put in service on 02.04.2019 20:38 hrs.

Committee observed the following:

- MS enquired about the thermo vision scanning for hot spots was carried out on the substation equipment.
- GETCO representative informed that thermo vision scanning for hot spots was carried out on the substation equipment but did not find any hot spots in and around the failed equipment. He further informed that it was a mechanical failure.
- The operation of bus bar protection was found in order.

Committee suggested proper maintenance of sub-station equipment may help in reducing similar type of incidents in future.

2A.5.	Substation:	400 kV Wanakbori power station
	Date & time:	27.04.2019 at 00:59 hrs.
	Event Category:	GI-2

2A.5.1 : Event Summary:

- On 27.04.2019 at 00.59 hrs there was a grid incidence at 400 kV Wanakbori power station.
- At 400 kV Wanakbori power station, 400/220 kV ICT 1 & Unit 4 GT Tie bay B phase CT blasted and resulted in tripping of the main bays of the above said elements.
- Tripping's observed are as follows:

  1.400/220 kV Wanakbori ICT 1

  2.210 MW Wanakbori Unit 4

SLD/Event report is enclosed as **Annexure 2A.5**.

2A.5.2 : Discussion in 136th PCM

GSECL representative gave a brief on the disturbance as follows;

The position of various 400KV lines/Bus/ICT/Units before incident was as under:

Unit – 4 – On bar	220 KV side of ICT – On load
Unit – 5 – On bar	400 KV side of ICT – On load
Unit – 6 – On bar	400 KV bus – I – On load
Unit – 7 – On bar	400 KV bus – II – On load
400 KV Asoj - On load	400 KV Soja – On load
400 KV Dehgam – On load	500 MVA ICT – On load

Sequence of events happed during the occurrence are as follows:-

- On 27-04-2019, at 00:59 Hrs, 400 KV CT-3 - B-Phase busted and resulted into fire and spillage of oil around surrounding area of Unit # 4 bay.
- Unit # 4 was tripped on Overall Differential protection (87GT), Restricted Earth Fault protection (64GT), Class-A tripped.
- ICT tripped with the following indications:

  (1) 400 KV side Relay indication: Transformer Differential Protection – 87M1, Definite Time O/C Protection - 50RYB,

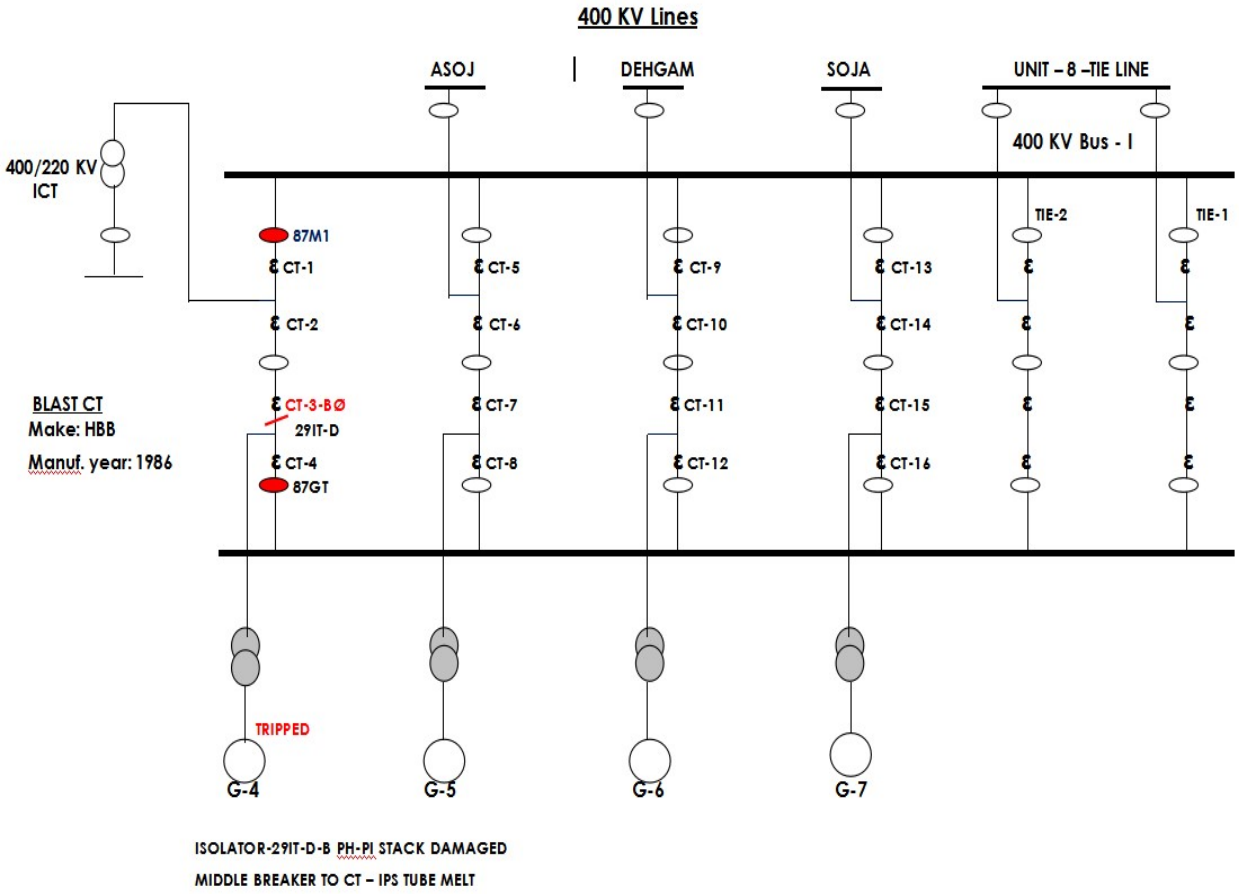
  (2) 220KV SIDE Relay indication: Instant O/C Relay 50RYB, Tripping Relay 86 ICT-1 and 86 ICT-2

Sequences of restoration are as follows.

1	500 MVA 400/220KV ICT Charged	27.04.19	03.32 Hrs
2	Unit#4 M/C Synchronized	27.04.19	05.17 Hrs

- The 400 KV CT–3 (B-Ph) was manufactured by M/s HBB in 1986 and was commissioned in 1986-87.

SLD for 400 kV Wanakbori power station at the time of occurrence are as follows:-



Committee observed the following:

- MS,WRPC enquired about the test results which were carried on the failed equipment.
- GSECL representative informed that the failed 400 KV CT–3 (B-Ph) was manufactured by M/s HBB in 1986 and was commissioned in 1986-87 and also informed that the test results which were carried on the failed equipment were satisfactory. He further informed that GSECL is in the process of replacing all the CTs which are more than 25 years with the new ones.

Committee noted.

2A.6.	Substation:	400 kV Wanakbori power station
	Date & time:	27.04.2019 at 21:21 hrs.
	Event Category:	GI-2

2A.6.1 : Event Summary:

- On 27.04.2019 at 21.21 hrs there was a grid incidence at 400 kV Wanakbori power station.
- At 400 kV Wanakbori power station, 400 kV Soja 1 & Unit 7 GT Tie bay B phase CT blasted and resulted in tripping of 400 kV Bus 2, 400 kV Wanakbori-Asoj,400 kV Wanakbori-Dehgam 1, 400 kV Wanakbori-Soja 1 and 210 MW Wanakbori Units 4,6&7
- Tripping's observed are as follows:

  1.400 kV Wanakbori-Asoj
  2.400 kV Wanakbori-Dhegam 1
  3.400 kV Wanakbori-Soja 1
  4.210 MW Wanakbori Units 4,6&7

SLD/Event report is enclosed as **Annexure 2A.6**.

2A.6.2 : Discussion in 136th PCM

GSECL representative gave a brief on the disturbance as follows;

The position of various 400KV Lines/Bus/ICT/Units before incident was as under:

Unit – 4 – On bar	220 KV side of ICT – On load
Unit – 5 – On bar	400 KV side of ICT – On load
Unit – 6 – On bar	400 KV bus – I – On load
Unit – 7 – On bar	400 KV bus – II – On load
400 KV Asoj - On load	400 KV Soja – On load
400 KV Dehgam – On load	500 MVA ICT – On load

Sequence of events happed during the occurrence are as follows:-

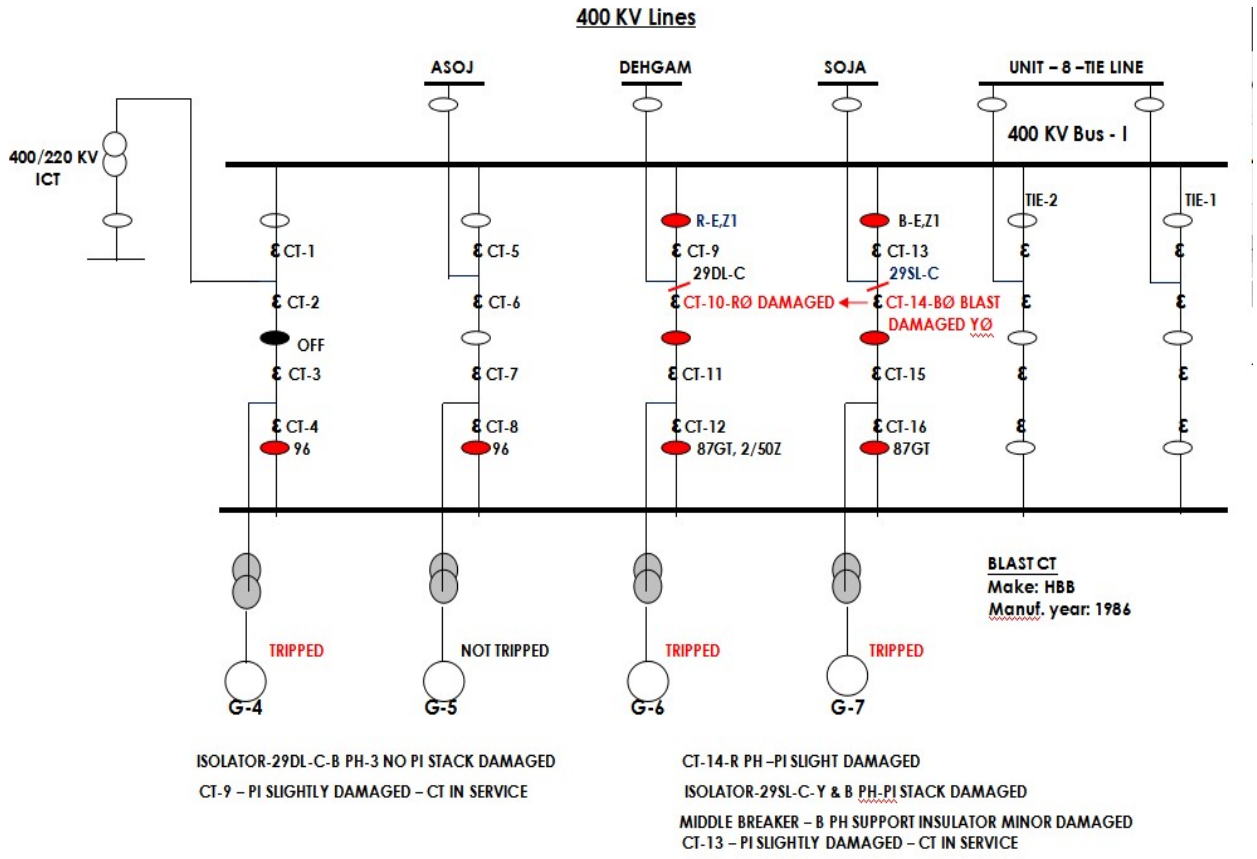
- On 27-04-2019, at 21:21:09 Hrs, 400KV CT-14 - B-Phase busted and resulted into heavy fire and spillage of oil around surrounding area of Unit # 6 and Unit # 7 bay.
- Unit # 6 and 7 were tripped on Overall Differential protection (87GT) and Restricted Earth Fault protection (64GT), Class-A tripped.
- Unit # 4 and 5 GT Breakers were tripped on Bus-II Busbar protection due to LBB protection of Unit # 6 GT operated.
- 400 KV Asoj Line was tripped from opposite end.
- 400 KV Dehgam Line Tripped on Line Distance Protection : R-E, Zone-1, Carrier Send.
- 400 KV Soja Line tripped on Line Distance Protection : B-E, Zone-1, Carrier Send.

- Unit # 5 was survived through Middle Breaker and ICT.
- 400kv Dehgam Line Tripped On Unit#6 Middle Breaker LBB Protection and Line Distance Protection.
- The 400KV CT – 14 (B-Ph) was manufactured by M/s HBB in 1986 and was commissioned in 1986-87.

Sequences of restoration are as under:

1	400 KV Bus-II Charged through Tie Line-1 (Unit#8)	27.04.19	23.05 Hrs
2	GT # 5 Breaker Made On.	27.04.19	23.15 Hrs
3	400 KV Wanakbori-Dehgam Line Charged.	28.04.19	00.35 Hrs
4	400 KV Wanakbori-Asoj Line Charged.	28.04.19	01.05 Hrs
5	Unit # 4 M/C Synchronized	28.04.19	01.13 Hrs
6	Unit # 7 M/C Synchronized	28.04.19	03.40 Hrs
7	Unit # 6 Ready For Lit Up. (Declared RSD)	28.04.19	07.30 Hrs

SLD for 400 kV Wanakbori power station at the time of occurrence are as follows:-



Committee observed the following:

- MS,WRPC enquired about the test results which were carried on the failed equipment.
- GSECL representative informed that the failed 400 KV CT–14 (B-Ph) was manufactured by M/s HBB in 1986 and was commissioned in 1986-87 and also informed that the test results which were carried on the failed equipment were satisfactory. He further informed that GSECL is in the process of replacing all the CTs which are more than 25 years with the new ones.

Committee noted.

2A.7.	**Substation:**	**400 kV Wanakbori power station**
	Date & time:	**28.04.2019 at 22:46 hrs.**
	Event Category:	GI-2

2A.7.1 : Event Summary:

- On 28.04.2019 at 22.46 hrsthere was a grid incidence at 400 kV Wanakbori power station.
- At 400 kV Wanakbori power station, 400 kV Asoj & Unit 5 GT Tie bay CT blasted and resulted in tripping of the main bays of the above said elements.
- Tripping's observed are as follows:
  1.400 kV Wanakbori-Asoj
  2.210 MW Wanakbori Unit 5

SLD/Event report is enclosed as **Annexure 2A.7**.

2A.7.2 : Discussion in 136th PCM

GSECL representative gave a brief on the disturbance as follows;

The position of various 400KV Lines/Bus/ICT/Units before incident was as under:

Unit – 4 – On bar	220 KV side of ICT – On load
Unit – 5 – On bar	400 KV side of ICT – On load
Unit – 7 – On bar	400 KV bus – I – On load
400 KV Asoj - On load	400 KV bus – II – On load
400 KV Dehgam – On load	500 MVA ICT – On load

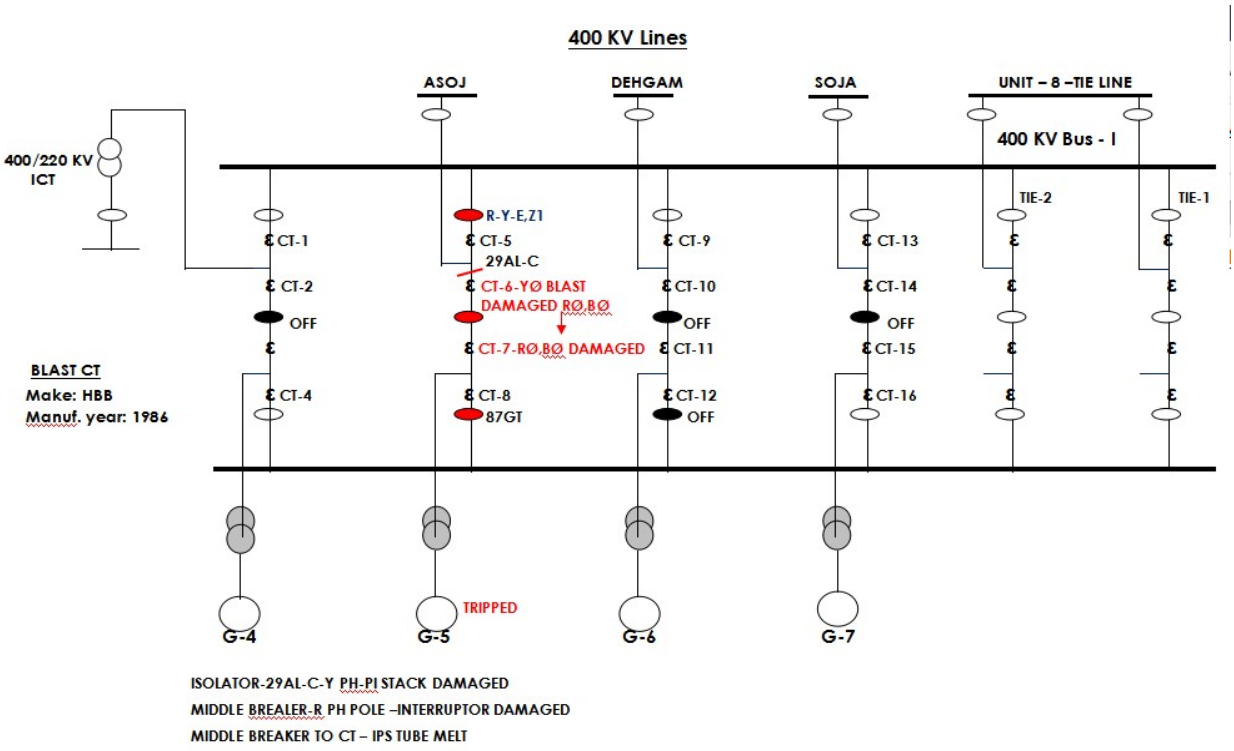
Sequence of events happed during the occurrence are as follows:-

- On 28-04-2019, at 22:48 Hrs, 400 KV CT-6 - Y-Phase burst and resulted into fire and spillage of oil around surrounding area of Unit # 5 bay.
- Unit # 5 tripped on Overall Differential protection (87GT) and Restricted Earth fault protection (64GT), Class-A tripped.
- 400 KV Asoj Line Tripped on Line Distance Protection : R/Y-E, Zone-1, Carrier Send.
- The 400 KV CT–6 (Y-Ph) was manufactured by M/s HBB in 1986 and was commissioned in 1986-87.

Sequences of restoration are as under.

1	400kv Asoj Line Charged	29.04.19	01.42 Hrs

SLD for 400 kV Wanakbori power station at the time of occurrence are as follows:-



Committee observed the following:

- MS,WRPC enquired about the test results which were carried on the failed equipment.
- GSECL representative informed that the failed 400 KV CT–6 (Y-Ph) was manufactured by M/s HBB in 1986 and was commissioned in 1986-87 and also informed that the test results which were carried on the failed equipment were satisfactory. He further informed that GSECL is in the process of replacing all the CTs which are more than 25 years with the new ones.

Committee noted.

2A.8.	**Substation:**	**400 kV Wanakbori power station**
	Date & time:	**29.04.2019 at 23:04 hrs.**
	Event Category:	GI-2

2A.8.1 : Event Summary:

- On 29.04.2019 at 23.04 hrs there was a grid incidence at 400 kV Wanakbori power station.
- At 400 kV Wanakbori power station,while closing the tie breaker (408) of Dehgam line and Unit 6 GT at Wanakbori,tie line-1 tie breaker tripped due to which 400kV main bus-2 got isolated.
- Due to isolation of 400kV Bus-2, Unit-4, Unit-5 and Unit-7 tripped due to loss of evacuation path.
- Tripping's observed are as follows:

  1.400 kV Wanakbori-Dhegam 1

  2.210 MW Wanakbori Units 4,5&7

SLD/Event report is enclosed as **Annexure 2A.8**.

2A.8.2 : Discussion in 136th PCM

GSECL representative gave a brief on the disturbance as follows;

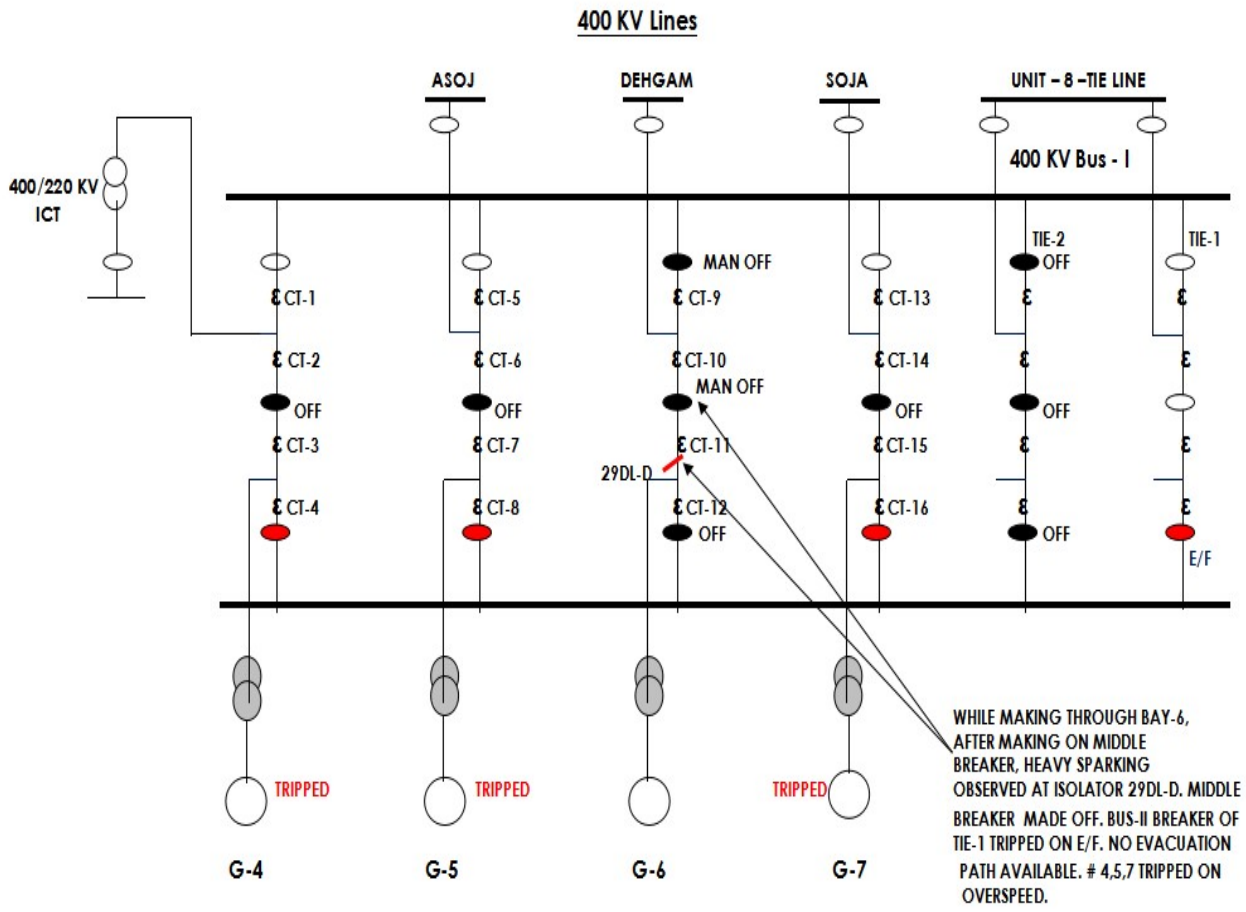
The position of various 400KV Lines/Bus/ICT/Units before incident was as under:

Unit – 4 – On bar	220 KV side of ICT – On load
Unit – 5 – On bar	400 KV side of ICT – On load
Unit – 7 – On bar	400 KV bus – I – On load
400 KV Asoj - On load	400 KV bus – II – On load
400 KV Dehgam – OFF load	500 A ICT – On load

Sequence of events happed during the occurrence are as follows:-

- On 29-04-2019, at 22:48 Hrs, after replacing CT-10 – R-Phase, while making through Bay-6, Line breaker of 400 KV Dehgam made ON. Then Middle Breaker was made ON. Heavy sparking observed on Isolator 29DL-D. Immediately, OFF command given to Middle Breaker and Dehgam Line Breaker.
- Due to heavy sparking Tie Line -1 tripped on Earth Fault. Tie Line-1 was the only evacuation path for Unit # 4, 5, 7.
- As no power evacuation path available for Unit # 4, 5, 7 generation, all three units tripped on over speed.

SLD for 400 kV Wanakbori power station at the time of occurrence are as follows:-



Committee noted as above.

2B.Madhya Pradesh system:

2B.1.	**Substation:**	**400/220 kV Pithampur**
	Date & time:	**15.04.2019 at 00:49 hrs.**
	Event Category:	GI-2

2B.1.1 : Event Summary:

- On 15.04.2019 at 00.49 hrs there was a grid incidence at 400/220 kV Pithampur s/s.
- At 400/220 kV Pithampur s/s, R phase CT of 220 kV TBC blasted resulted in tripping of all the elements connected to 220 kv bus 2 on bus bar protection operation.
- 220 kV Pithampur Interconnector 2 was connected to 220 kV Bus 2 through 220 kV TBC due to the problem in Main breaker.
- Tripping's observed are as follows:
  1.220 kV Pithampur Interconnector 2
  2.220 kV Pithampur-Badnagar
  3.400/220 kV 315 MVA Pithampur ICT 2

SLD/Event report is enclosed as **Annexure 2B.1**.

2B.1.2 : Discussion in 136th PCM:

Committee observed that MPPTCL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2B.2.	**Substation:**	**765 kV Khandwa-Dhule line**
	Date & time:	**16.04.2019 at 18:34 hrs.**
	Event Category:	GI-2

2B.2.1 :Event Summary:

- On 16.04.2019 at 18.34 hrs there was a grid incidence at 765 kV Khandwa-Dhule line.
- 765 kV Khandwa-Dhule line which was under construction collapsed and fell over the 400 kV Pithampur-Singhaji 1&2, 400 kV Khandwa-Indore 1&2, 220 kV Omkareshwar-Barwaha and 220 kV Omkareshwar-Nirmani and resulted in tripping of the lines on distance protection operation.
- Tripping's observed are as follows:
  1.400 kV Pithampur-Singhaji 1&2
  2.400 kV Khandwa-Indore 1&2
  3.220 kV Omkareshwar-Barwaha
  4.220 kV Omkareshwar-Nirmani

SLD/Event report is enclosed as **Annexure 2B.2**.

2B.2.2 : Discussion in 136th PCM:

Committee observed that MPPTCL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2B.3.	**Substation:**	**400/220 kV Pithampur**
	Date & time:	**28.04.2019 at 07:28 hrs.**
	Event Category:	**GI-1**

2B.3.1 :Event Summary:

- On 28.04.2019 at 07.28 hrs there was a grid incidence at 400/220 kV Pithampur s/s.
- At 400/220 kV Pithampur s/s, R phase CT of 220 kV Pithampur Interconnector blasted and all the elements connected to 220 kv Bus 1 and 2 tripped.
- Tripping's observed are as follows:
  1.220 kV Pithampur-Badnagar
  2.220 kV Pithampur Interconnector 1&2
  3.400/220 kV 315 MVA Pithampur ICT 1&2

SLD/Event report is enclosed as **Annexure 2B.3**.

2B.3.2 : Discussion in 136th PCM:

Committee observed that MPPTCL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2B.4.	**Substation:**	**220 kV Seoni(MP)**
	Date & time:	**29.04.2019 at 18:10 hrs.**
	Event Category:	GD-1

2B.4.1 :Event Summary:

- On 29.04.2019 at 18.10 hrs there was a grid incidence at 220 kV Seoni(MP) s/s.
- At 220 kV Seoni(MP) s/s, 220 kV bus coupler B phase CT blasted and resulted in tripping of 220 kV Seoni(MP)-Seoni(PG) 1&2 and 220/132 kV 160 MVA Seoni(MP) ICTs 1&2.
- 132 kV Lalbuara, Pench, Mandla and Seoni load got affected due to the event.
- Tripping's observed are as follows:
  1.220 kV Seoni(MP)-Seoni(PG) 1&2
  2.220/132 kV 160 MVA Seoni(MP) ICTs 1&2

SLD/Event report is enclosed as **Annexure 2B.4**.

2B.2.2 : Discussion in 136th PCM:

Committee observed that MPPTCL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2C. Maharashtra system

2C.1.	**Substation:**	**400/220 kV Kalwa**
	Date & time:	**05.01.2019 at 19:38 hrs.**
	Event Category:	GI-1

2C.1.1: Event Summary:

- On 05.01.2019 at 19.38 hrs there was a grid incidence at 400/220 kV Kalwa s/s.
- At 400/220 kV Kalwa s/s, 220kV Kalwa –Airoli Knowledge Park wavetrap failed and all the elements connected to 220 kv Bus 2 tripped.
- Trippings observed are as follows:

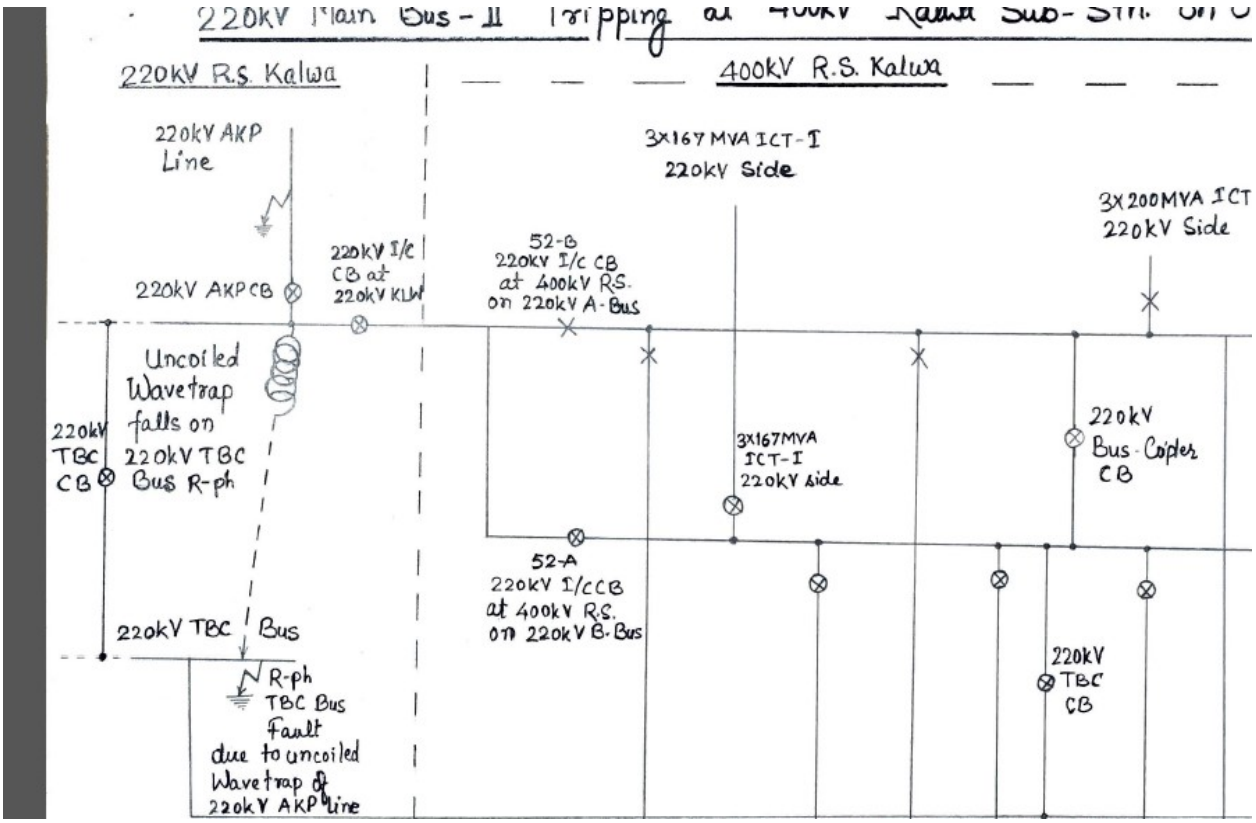
  1.400/220 kV 500 MVA Kalwa ICT 1&3
  2.220 kV Kalwa-Mulkund 2
  3.220 kV Kalwa-Salsette 4
  4.220 kV Kalwa-colorchem
  5.220 Kalwa-Trombay
  6.220 kV Kalwa-Borivalli
- The Event Report is enclosed at **Annexure 2C.1**

2C.1.2: Discussion in 136th PCM:

MSETCL representative informed the following;

- At line fault occurred on 220kV Kalwa-AKP line wave trap damaged at 220kV AKP substation, subsequently wave trap at 220kV Kalwa end also uncoiled.
- The uncoiled wave trap at 220kV Kalwa substation falls on 220kV TBC bus which was in service and kept parallel with 220kV Interconnector as per LD Kalwa instruction.
- In this event, the 220kV TBC breaker parallel with 220kV Interconnector tripped at both substations.
- During this event the 220kV Main Bus-II also tripped with 220kV Bus-Coupler and 220kV Interconnector (52-A CB) on LBB command through C-Zone extension i.e. 220kV TBC CB at 220kV R.S. Kalwa. The initiated LBB command is due to spurious command.
- The 220kV Bus Bar Main Protection Zone-II Y-ph Unit has recorded 3 Nos. of LBB Optd. ON/OFF events in 100ms span which validate that the tripping of 220kV Bus- II on LBB Protection due spurious command.
- Since there is no actual Bus Fault, the Main Bus-II restored to normal.

SLD of 220kV Airoli Knowledge Park S/s during the event as follows:-



Remedial measures taken after the event are as follows:-

- While taking line in service follow standard procedure of operations.
- Bus bar need to taken in service at earliest.

Committee observed the following:

- Committee observed that Wavetrap of 220 kV Kalwa-AKP line was damaged at AKP end that created Y&B phase fault and the line tripped on zone 2 distance protection from Kalwa end.
- Kalwa end wave-trap of the same line was uncoiled and it fell on 220 kV transfer bus at Kalwa and created R&Y phase fault after two seconds. Spurious LBB signal generated and tripped all the elements connected to 220 kV Kalwa Bus B along with 220 kV TBC CB connecting 220 kV Kalwa Bus A & B with Transfer bus, 220 kV interconnector and 220 kV BC.
- It was observed from the PMU plot, the fault due to the uncoiled wave trap was cleared within 120 ms and the operation of LBB was highly undesirable.

Committee observed that mal operation of LBB relay was undesirable. Committee also observed that regular maintenance of equipment may avoid such type of occurrences in future and also requested MSETCL to analyze the cause of mal operation of the LBB relay and submit the analysis report to PCM at the earliest.

2C.2.	Substation:	400 kV Chandrapur station
	Date & time:	04.01.2019 at 16:40 hrs.
	Event Category:	GD-2

2C.2.1: Event Summary:

- On 04.01.2019 at 16.40 hrs there was a grid incidence at 400 kV Chandrapur station.
- At 400 kV Chandrapur station, while transferring 400 kV HVAC circuit 1 of HVDC pole 2 from main bus 2 to transfer bus, B pole of Bus 2 side isolator got stuck resulted in sparking followed by tripping of all the elements connected to 400 kV Bus 2 on Bus Bar protection operation.
- At the same time HVDC Bhadravati pole 2 tripped on low voltage.
- Trippings observed are as follows:

  1.400/220 kV 500 MVA Kalwa ICT 1&3
  2.220 kV Kalwa-Mulkund 2
  3.220 kV Kalwa-Salsette 4
  4.220 kV Kalwa-colorchem
  5.221 Kalwa-Trombay
  6.220 kV Kalwa-Borivalli

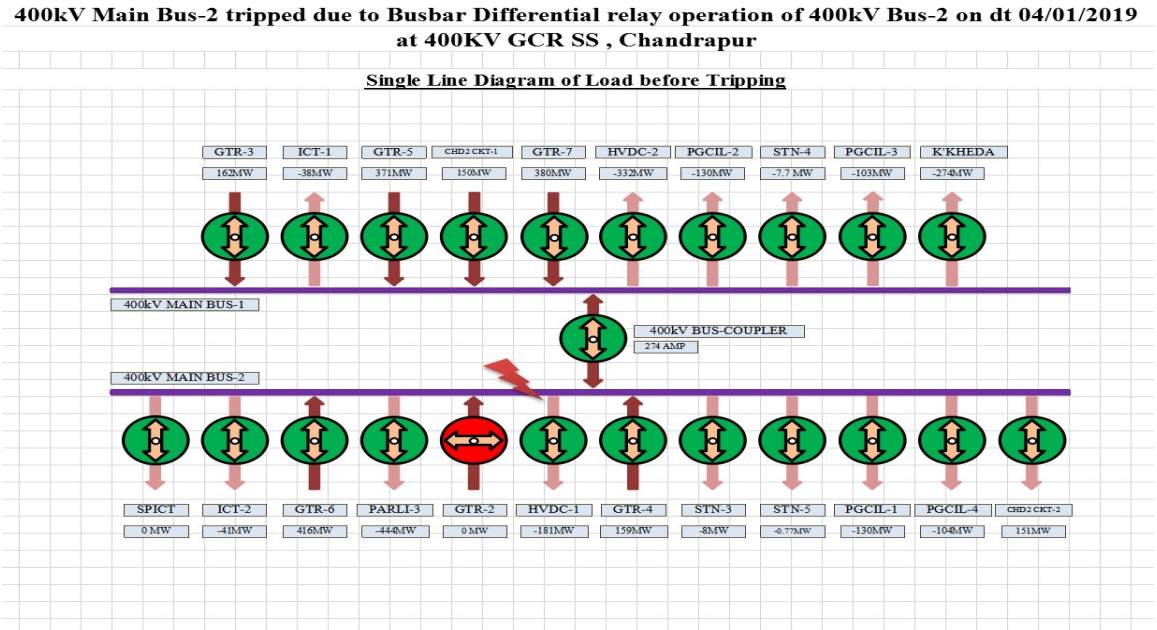
- The Event Report is enclosed at **Annexure 2C.**

2C.2.2: Discussion in 136th PCM:

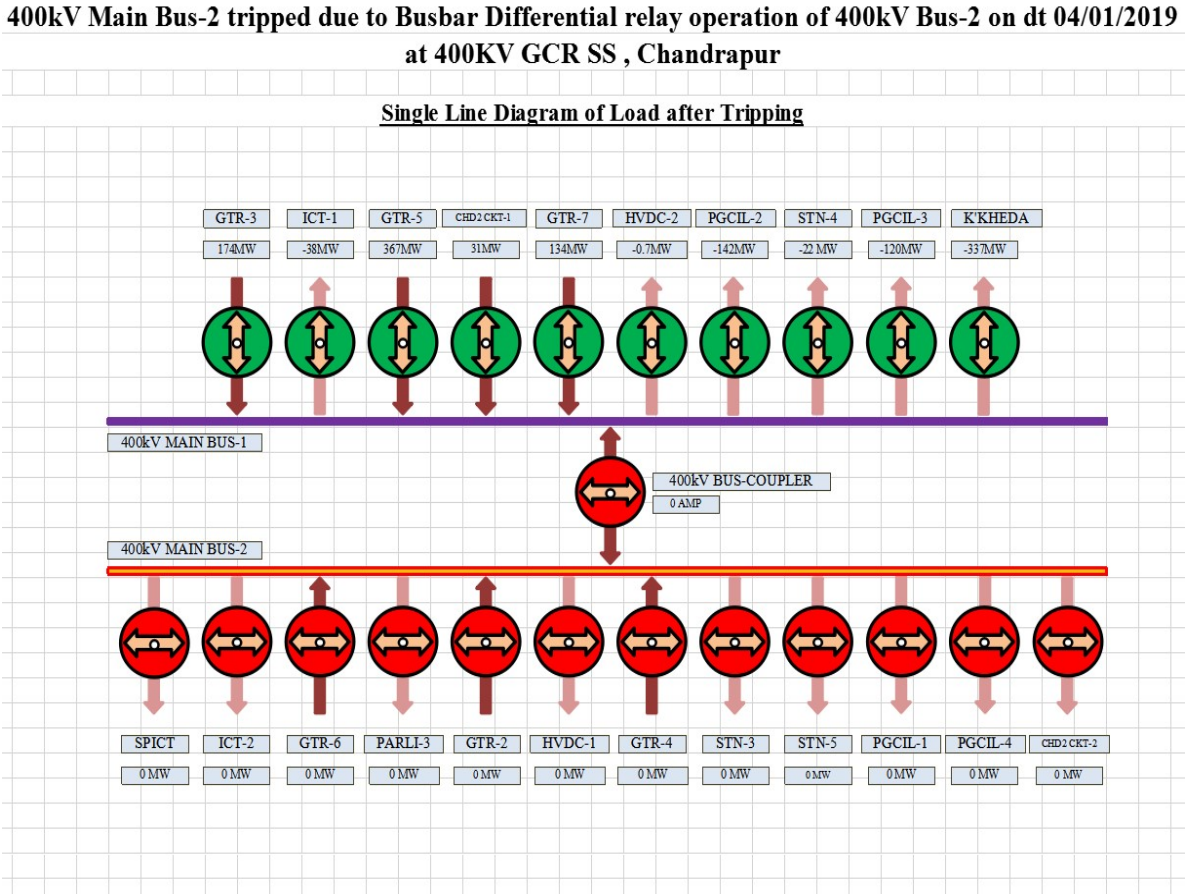
MSETCL representative informed the following;

- On 04.01.2019 at 16:40Hrs, due to oil leakage problem in CB of 400KV HVDC circuit I, shifting of 400KV HVDC ckt I from Main Bus II to TBC II was initiated.
- During shifting on TBC-II, B-Ph Bus-2 Isolator (pentagraph) of TBC-II got struck with flashover on support insulator, causing Bus II fault & resulted in operation of Busbar protection along with tripping of all feeders connected to 400KV Main Bus II.

SLD of 400 KV Chandrapur station before tripping is given below:



SLD of 400 KV Chandrapur station after tripping is given below:



Committee observed the following:

- Committee observed that on 04.01.2019 at 16:40 Hrs, while shifting of 400KV HVDC ckt I from Main Bus II to TBC II Bus, B-ph Bus-2 isolator of TBC II got stuck in induction zone, which caused heavy continuous sparking in isolator contacts and also flashover between live part & rotary support insulator resulted in B-Ph to earth fault which leads to operation of 400KV Main Bus II Busbar protection relay. Which resulted in tripping of all the feeder connected to Bus II.
- Operation of 400KV Main Bus II busbar protection is in order.

Committee observed that periodic maintenance of isolators at 400 KV substations to avoid this kind of trippings in future.

2C.3.	Substation:	400/220 kV Lonikhand sub station
	Date & time:	05.03.2019 at 07:33 hrs.
	Event Category:	GI-1

2C.3.1: Event Summary:

- On 05.03.2019 at 07.33 hrs there was a grid incidence at 400/220 kV Lonikhand substation.
- At 220kV Lonikhand, R phase CT clamp of 220 kV Ranjangaon circuit broke.
- 220 kV Bus 1 tripped on Bus bar protection operation along with all the connected elements.
- Tripping's observed are as follows:
  1.220 kV Lonikhand-Theur
  2.220 kV Lonikhand- Ranjangaon
  3.400/220 kV Lonikhand ICT 1&3
- The Event Report is enclosed at **Annexure 2C.3.**

2C.3.2: Discussion in 136th PCM:

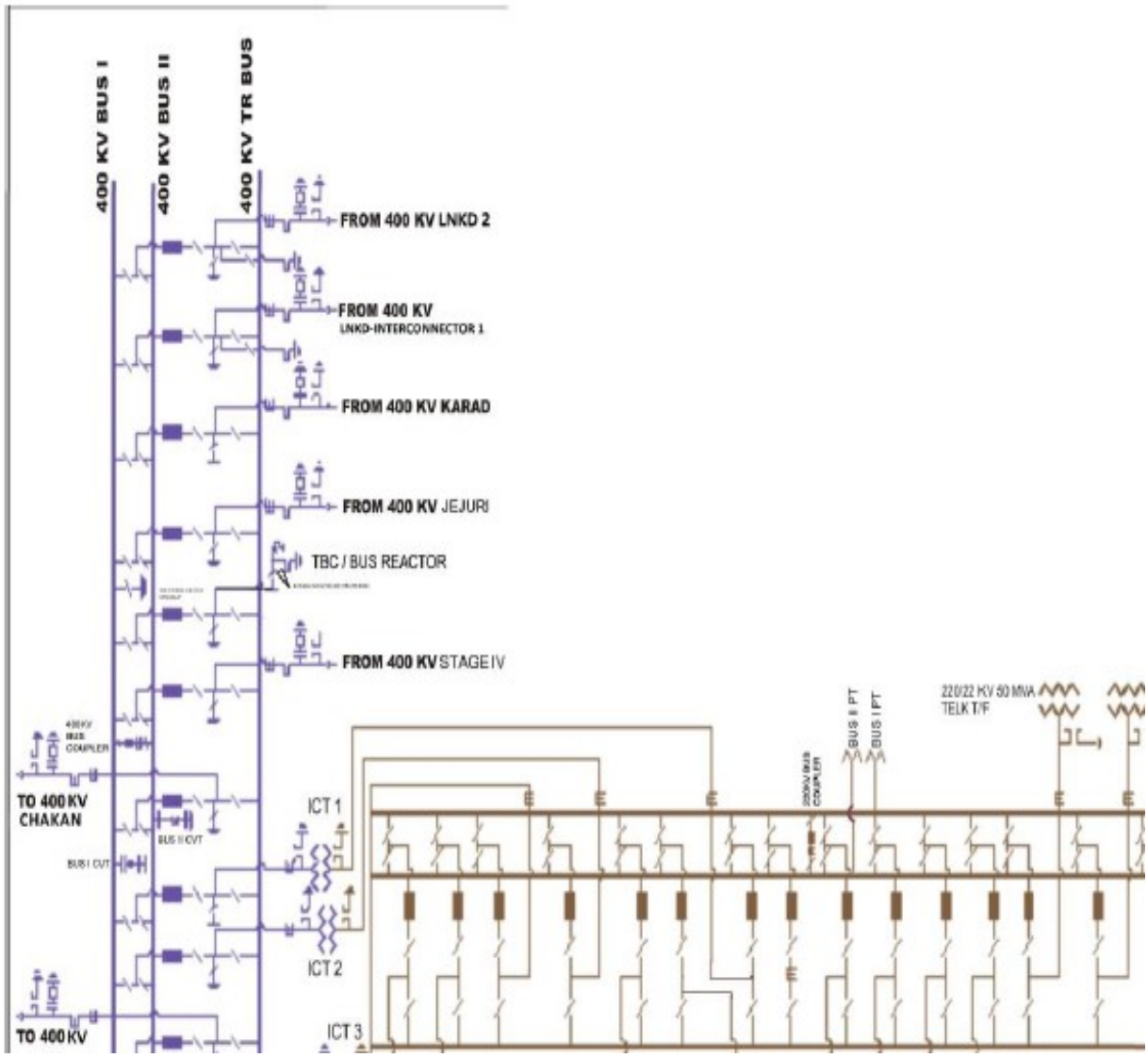
MSETCL representative informed the following;

- On date 05.03.2019 at 05.03.2019 Hrs. at 400 kV Lonikand RS B phase jump of 220kV Ranjangaon bay break down near CT and due to this Ranjangaon bay distance relay operated, B phase with zone 1 fault.
- At the same time the snapped conductor created earth fault on P-I side of CT with nearby gantry structure, due to which zone 1 of RADSS bus bar scheme operated and tripped all bays connected to Bus 'A' at Lonikand Substation.

Sequence of events during the incident are as follows:-

SN	Name of S/stn	Name of Feeder/Equipment	Tripping date	Tripping Time	Local end	Remote end
1	400 kV Lonikand I I	Lonikand Ranjangaon line	05.03.2019	7:33	Distance protection operated, B phase, zone 1.	B phase-Earth , Zone-1, Carrier receive , carrier send,
2		BUSBAR PANEL			ABB MAKE RADSS BUS BAR PROTECTION OPERATED	

SLD of 400/220 kV Lonikhand substation S/s during the event as follows:-



After the incident restoration of elements are as follows:

SN	Name of S/stn	Name of Feeder/Equipment	Restoration time	Time	Duration
1	400 kV Lonikand I	Lonikand Ranjangaon line	05.03.2019	17:02	9:29
2		Bus Coupler	05.03.2019	8:09	0:36
3		400/220 315MVA ICT-III	05.03.2019	8:11	0:38
4		Lonikand-Theur-I	05.03.2019	8:14	0:41
5		400/220 315MVA ICT-I	05.03.2019	8:14	0:41
6		220/22kV 50MVA T/F-III	05.03.2019	8:13	0:40
7		220/22kV 50MVA T/F-I	05.03.2019	8:15	0:25

Committee observed the following:

- Committee observed that at 400 kV Lonikand RS, B phase jump of 220kV Ranjangaon bay break down near CT and due to this Ranjangaon bay distance relay operated, B phase with zone 1 fault. This resulted in tripping of Lonikand Ranjangaon line.
- Committee also observed that at the same time the snapped conductor created earth fault on P-I side of CT with nearby gantry structure, due to which zone 1 of RADSS bus bar scheme operated and tripped all bays connected to Bus 'A' at Lonikand Substation. The selective tripping of Bus bar operation was found in order.

Committee noted.

2C.4.	**Substation:**	**400 kV Aurangabad (MH) (400kV Waluj S/S)**
	Date & time:	**05.03.2019 at 09:29 hrs.**
	Event Category:	GD-2

2C.4.1: Event Summary:

- On 05.03.2019 at 09.29 hrs there was a grid incidence at 400 kV Aurangabad (MH) s/s.
- At 400 kV Aurangabad (MH) s/s, 400 kV Bus 1 Bus bar protection mal-operated while taking outage of 400kV Aurangabad (MH)-Taptithanda and resulted in tripping of all the elements connected to 400 kV Bus 1.
- At the same time HVDC Bhadravati pole 2 tripped on low voltage.
- Tripping's observed are as follows:
  1.400 kV Aurangabad (MH)-Deepnagar
  2.400 kV Aurangabad (MH)-Aurangabad 2
  3.400 kV Aurangabad (MH)-Pune 2
  4.400/220 kV, 315 MVA Aurangabad (MH) ICT 1
  5.400/220 kV, 315 MVA Aurangabad (MH) ICT 2

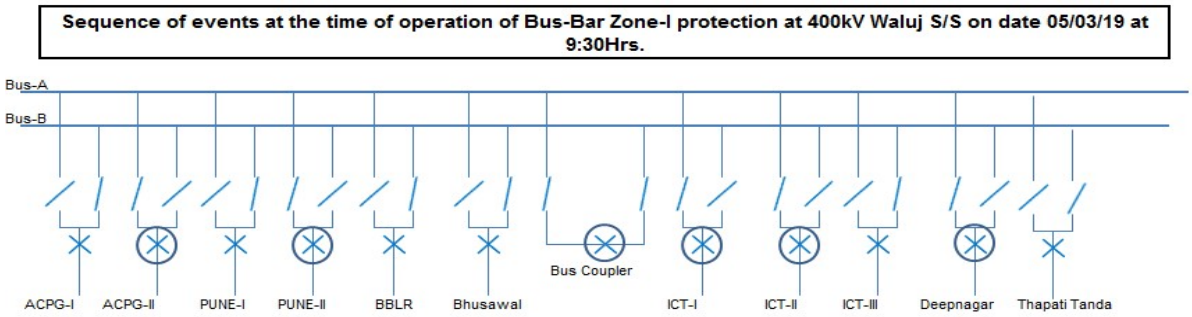
- The Event Report is enclosed at **Annexure 2C.4.**

2C.4.2: Discussion in 136th PCM:

MSETCL representative informed the following;

- At 400kV Waluj S/S 400kV on date 05.03.19 at 09:30 Hrs Bus-bar protection for Zone-2 operated.
- This scheme is having main zone and check zone. Indications T and U observed on RADSS Main-II only.
- Before to operation of Busbar protection load on S/S was 1327 MW.

SLD of 400 kV Aurangabad (MH) S/s during the event as follows:-



Sequences of Events during the incidence are as follows:

- At 400kV Waluj Substation, there is 2M+Aux Bus arrangement with old Busbar Scheme ABB RADSS having main zone and check zone. For availing outage on 400kV Thaptitanda, its breaker opened also its line isolator opened however while preparing for opening of its bus isolator 29B;
- As soon as its control DC made ON; Busbar protection Zone A operated and Isolator Control DC MCB in respective panel tripped.
  It was reported that R & U flag of Zone A only operated and no operation of CHECK ZONE.
- Also DR of ACPG Line -I &Line-II triggered by operation of Busbar protection was checked & did not found any evidence of fault current.
  Hence all bays were restored.
- After restoring of all bays it was observed that the isolator control DC MCB of Thapatitanda bay tripped due to damage of control cable by gnawing by rat /animal.

Remedial measures taken post to the occurrence are as follows:-

- The control cable which was damaged was replaced. All this operation sequence & indications suggest Mal-operation of Busbar scheme due to DC leakage.
- This busbar protection scheme now replaced and will be taken into service shortly.

Committee observed the following:

- Committee observed that mal-operation of Busbar scheme may be due to DC leakage because of the damaged of control cable by gnawing by rat /animal as informed by MSETCL representative.

Committee suggested that periodic maintenance of switch yard equipment and relay panels may help in avoiding this kind of inadvertent mal operations in future.

2C.5.	Substation:	220 kV Satana s/s
	Date & time:	17.03.2019 at 20:50 hrs.
	Event Category:	GI-1

2C.5.1: Event Summary:

- On 17.03.2019 at 20.50 hrs there was a grid incidence at 220 kV Satana s/s.
- At 220 kV Satana s/s, 220 kV Main Bus, B phase CT blasted and caused tripping of 220 kV Main bus and all the elements connected to it on Bus bar protection operation.
- Tripping's observed are as follows:
  1.220 kV Satana-Malegaon
  2.220 kV Satana-Gangapur
  3.220/132 kV 200 MVA Satana ICT 1
  4.220/132 kV 150 MVA Satana ICT 2
- The Event Report is enclosed at **Annexure 2C.5.**

2C.5.2: Discussion in 136th PCM:

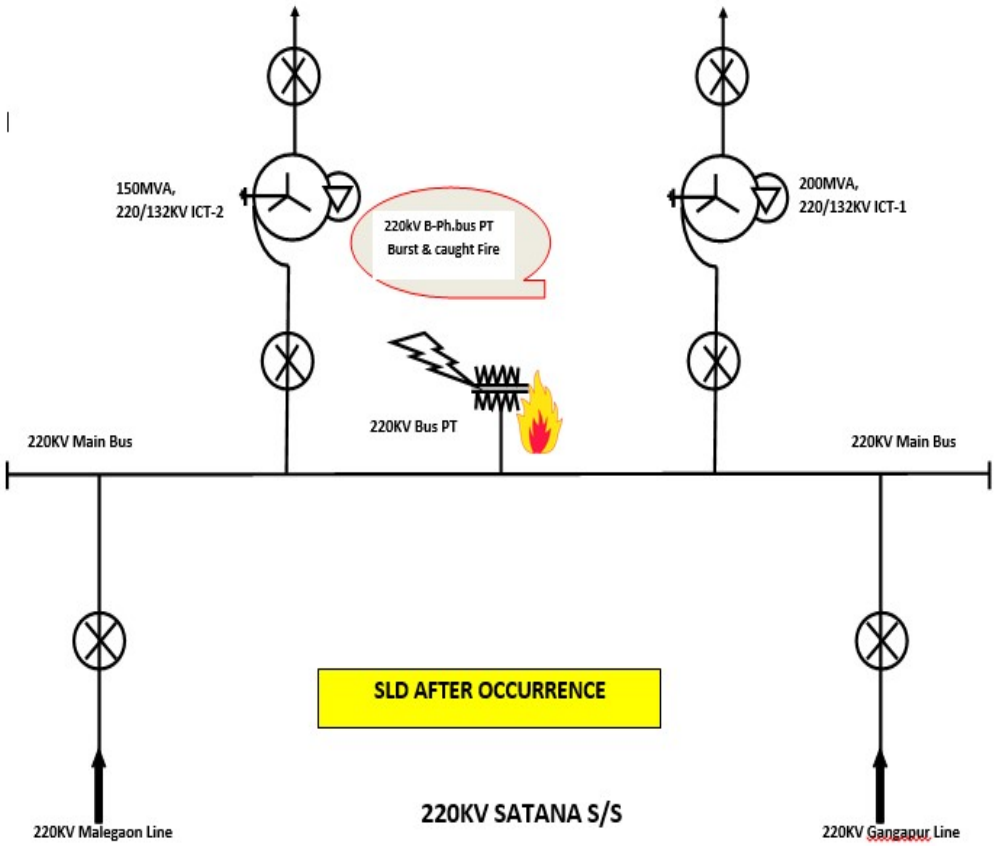
MSETCL representative informed the following;

- 220kV B-ph bus PT bursted and caught fire causing operation of 220kV Busbar Protection.
- All connected bays to 220kV Bus as per busbar protection scheme got tripped correctly. 220kV B-ph PT cable of all cores from PT secondary box to PTMB got burnt and damaged.

Sr. No.	Name of Feeder/bays	Date & Time		Duration (hrs)	Remark
		From	To		
1)	220kV Malegaon Line	17.03.19@20.50	17.03.19@22:36	01:46	Line charged to feed 220kV satana SS radially.
2)	200MVA ICT-1 HV	17.03.19@20.50	17.03.19@22:40	01:50	
3)	200MVA ICT-1 LV	17.03.19@20.50	17.03.19@22:45	01:55	Charged to feed 132kV Dindori.
5)	220KV Gangapur Line	17.03.19@20.50	18.03.19@13:12	15:22	
6)	150MVA ICT-2 HV	17.03.19@20.50	18.03.19@13:14	15:24	
7)	150MVA ICT-2 LV	17.03.19@20.50	18.03.19@13:19	15:29	

- 220kV "B"-ph Bus PT had C & Tan delta values measured on dt.03.06.2017 found to be 0.616 @ 10kV & 434.6 Pf @10kV.
- It has completed a service life of 20+ years.

SLD of 220 kV Satana s/s is given below:-



Remedial action taken after the occurrence as follows:-

- Tan delta values of "R" & "Y" phase PT was near to threshold value i.e. 0.687% & 0.5% respectively and hence rising trend in future is required to be observed.
- It is necessary to have 2nd set of 220 KV PT with PT change over arrangement to minimize the interruption period.

Committee observed the following:

- Committee observed that the B phase PT of 220 kV Satana Bus 1 blasted at 20:53 Hrs, which initiated BB protection operation and caused tripping of all the 220 kV bays at Satana substation. It was also observed from the PMU plot, the fault was cleared within 120 ms. 220/132 kV Satana ICT 1&2, 220 kV Gangapur and 220 kV Malegaon lines tripped at Satana substation.

Committee suggested submitting the PT failure analysis report to WRPC at the earliest. It was also suggested to have 2nd set of 220 KV PT with PT change over arrangement to minimize the interruption period as informed by the MSETC representative.

2C.6.	**Substation:**	**220 kV Boisar (MSETCL)**
	Date & time:	**18.03.2019 at 09:55 hrs.**
	Event Category:	GI-1

2C.6.1: Event Summary:

- On 18.03.2019 at 09.55 hrs there was a grid incidence at 220 kV Boisar (MSETCL) s/s.
- At Boisar (MSETCL) S/s, while carrying earthing rods in the Sub-Station, the rods came in the induction zone of 220kV Bus B causing tripping of all the elements connected to it.
- LTS operated due to the tripping of 220kV Boisar(MH)-Boisar 2&3 causing load relief of 159.2 MW.
- Tripping's observed are as follows:
  1. 220kV Boisar (MH) Bus B
  2. 220 kV Boisar(MH)-Boisar(PG) 2
  3. 220 kV Boisar(MH)-Boisar(PG) 3
  4. 220kV Boisar-Versova
  5. 220/132kV 200MVA Boisar(MH) ICT 1
  6. 220/132kV 150MVA Boisar(MH) ICT
  7. 220/33kV 50MVA ICT 1
- The Event Report is enclosed at **Annexure 2C.6.**

2C.6.2: Discussion in 136th PCM:

MSETCL representative informed the following;

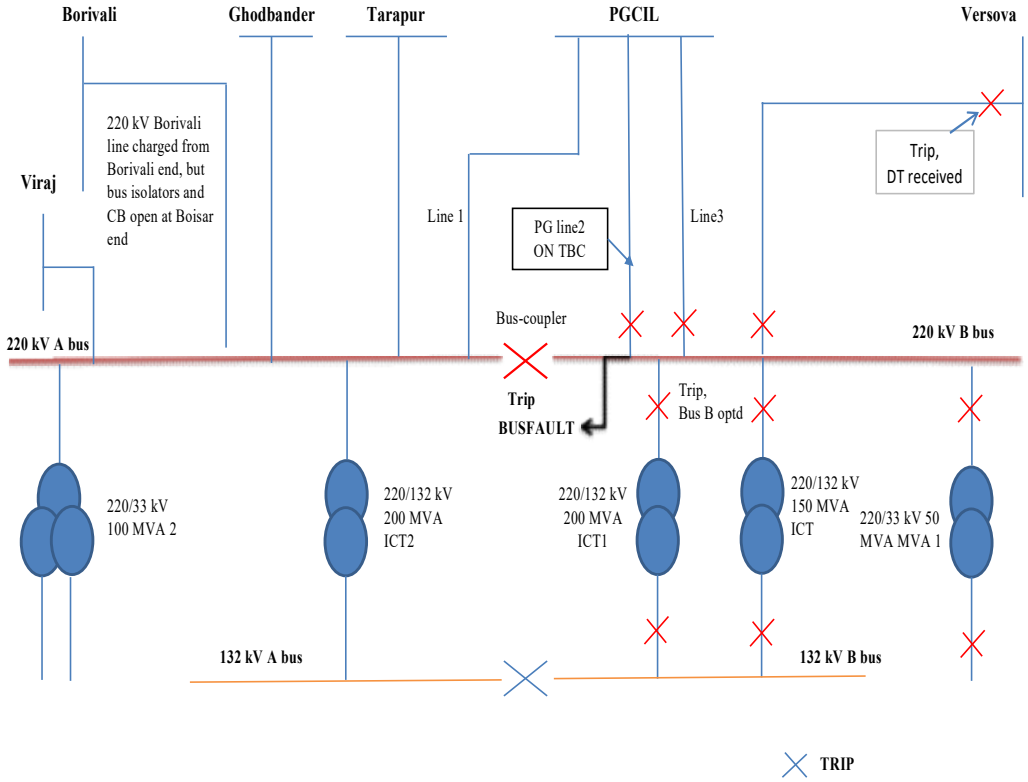
- On 18.03.2019 at 09:50 hrs, while providing additional earthing at Yph T point between 220kV A-Bus and 220kV B-Bus of 220kV PGCIL Line 2, earthing rod came in induction zone of 220kV B-Bus, creating B bus fault causing the operation of 220kV B-Bus and tripping of the connected Bays.
- 220 kV PGCIL Line no 2 (Bay 15) was taken on TBC for Own CB maintenance work, Own bay isolators (A, B, D) were open. While providing additional earthing for safety on Bay15 CB to bus isolator T (between A and B isolator), the earth rod came in induction zone of live B bus near Yph B bus isolator (due to loss of balance of the technician holding the earthing rod) causing Y-E Bus fault Busbar Zone B operation.
- The 220kV bays connected to B bus (as mentioned) along with bus coupler tripped at Boisar end and 220 kV Versova line tripped from Versova end over DT received.

Remedial measures suggested after the incidence are as follows:

- Proper tools and tackles should be used and operation / maintenance practices for outages should be followed strictly under supervision of concerned authority.

SLD of 220 kV Boisar (MSETCL) s/s is given below:-

At 220 kV Boisar2 ss , 220 kV B Bus Tripped over Y-E fault on 18.03.2019 09:50 Hrs



Committee observed the following:

- Committee observed that 220 kV Boisar-Boisar (PG) 2 was taken in TBC for its CB maintenance at 220 kV Boisar substation. While providing additional earthing at the 220 kV Bus side of CB, the earth rod came near the induction zone of Y Phase of 220 kV Bus 2 and all the elements connected to the 220 kV Bus 2 along with the Bus coupler tripped on Bus bar protection operation. After the tripping of 220 kV Boisar-Boisar (PG) 2&3, LTS scheme to avoid overloading of 220 kV Boisar-Boisar (PG) circuit 1 operated and there was a load shedding of 159.2 MW.
- Committee observed that life of the working personnel was at risk during the event and requested MSETCL follow the procedure and all the safety precautions during the work and also requested to take the corrective actions to ensure safety of staff and intimate the same to WRLDC/WRPC at the earliest.

Committee noted as above.

2C.7.	**Substation:**	**400 kV Karad s/s**
	Date & time:	**21.03.2019 at 10:50 hrs.**
	Event Category:	GI-2

2C.7.1: Event Summary:

- On 21.03.2019 at 10.50 hrs there was a grid incidence at 400 kV Karads/s.
- At Karad S/s, 400 kV Bus 1 tripped along with all the connected elements.
- At the same time, it was observed that R phase fault occurred in 400 kV Lonikhand-Karad 1 due to sugarcane burning and the line tripped.
- Tripping's observed are as follows:
  1. 400 kV Karad-Lonikhand 1
  2. 400 kV Karad-Talangade 1
  3. 400 kV Karad-Ney koyna 2
  4. 400 kV Karad-Jaigad 1
  5. 400/220 kV Karad ICT 1
  6. 400 kV 125 MVAR Karad BR
- The Event Report is enclosed at **Annexure 2C.7.**

2C.7.2: Discussion in 136th PCM:

MSETCL representative informed the following;

- 400 kv Karad-Lonikand line single phase tripped on distance protection R phase zone 1 at 10:49.24 Hrs. after 1 sec (dead time of Autorecloser cycle) reclosing command is given by distance relay but due to persistence fault on line AR lockout shot given by relay and CB tripped (all three poles)
- During AR lockout shot i.e. at 10:49.25, 400 kv Siemens make (7SS85-sip5) centralized numerical BUSBAR BUS zone 1 (i.e. BUS 1) operated on through fault of Lonikand line. (primary investigation-MAL operation of BUSBAR relay)
- Siemens make 7SS85 Bus Bar protection was commissioned on 26 OCT 2017. After commissioning same nature of fault occurred on 400 kV Karad-Lonikand line, 400 kV karad-New Koyana-1, 400 kV Karad-Talandge-1 &2 line but in past there is no mal operation of BUSBAR protection on through fault.

Relay/Flag Indications during the occurrence are as follows:

Sr. No.	Name of Feeder/bays	Local End Indication		Remote End Indication	
		WI	RI	WI	RI
1	400KV Karad-Lonikand	Main I, Main II Dist. Prot. optd, A/R optd.	Rph-E, Z-I, Ir-6.216KA, Dist-42.48Km	Dist. Protection optd.	Rph-E, Z-I, Ir-3.229KA, Dist-116Kms
2	400KV Bus Coupler			NA	NA
3	400/220KV 315MVA ICT-I	Nil	Nil	Nil	Nil
4	400KV Talandge-I	Nil	Nil	DT receive	Nil
5	400KV New Koyna-II	Nil	Nil	DT receive	Nil
6	400KV Jaigad-I	Nil	Nil	DT receive	Nil

Restoration of the ss elements are as follows:

Sr. No.	Name of Feeder/bays	Date & Time		Duration (hrs)	Remark
		From	To		
1	400KV Karad-Lonikand	10.49 Hrs	13:57 Hrs		400 kv Karad Lonikand line 'zone 1' distance protection operated with AR lockout shot due to sugarcane burning between loc. 113 & 114 (distance from Karad end is 42 km). During single phase tripping of line BUSBAR is stable but while AR lockout shot of distance relay, BUSBAR of BUS 1 is operated with line tripping. (MAL operation of BUSBAR on through fault)
2	400KV Bus Coupler	10.49 Hrs	11:38 Hrs	0:49	
3	400/220KV 315MVA ICT-I	10.49 Hrs	11:45 Hrs	0:56	
4	400KV Talandge-I	10.49 Hrs	11:47 Hrs	0:58	
5	400KV New Koyna-II	10.49 Hrs	11:48 Hrs	0:59	
6	400KV Jaigad-I	10.49 Hrs	11:52 Hrs	1:03	

Committee observed the following:

- Committee observed that the 400 kv Karad Lonikand line 'zone 1' distance protection operated with AR lockout shot due to sugarcane burning between loc. 113 & 114 (distance from Karad end is 42 km). During single phase tripping of line BUSBAR was stable but while AR lockout shot of distance relay, BUSBAR of BUS 1 is operated with line tripping. (MAL operation of BUSBAR on through fault).
- MSETCL representative informed that on detailed investigation by OEM, it was found that the end fault protection of the line became active and thereafter the differential current of Lonikhand feeder was not considered for differential calculation as per algorithm. He also informed that as suggested by the OEM, MSETCL changed the CB open time delay in End fault protection from 0 sec to 1.5 sec. There was no load loss due to the event.

Committee noted as above.

2C.8.	**Substation:**	**400/220 kV Padghe s/s**
	Date & time:	**28.03.2019 at 15:21 hrs.**
	Event Category:	GI-1

2C.8.1: Event Summary:

- On 28.03.2019 at 15.21 hrs there was a grid incidence at 400/220 kV Padghe s/s.
- At 400/220 kV Padghe s/s, 220 kV Themgar 2, Y phase Coupling capacitor blasted resulting in tripping of 400/220 kV Padghe ICT4, 400 kV Padghe-Boisar and 220 kV lines.
- Even though the Bus coupler and Bus sectionaliser opened, the elements connected to the other Bus tripped, may be due to the smoke and fumes created during the blasting of the capacitor.
- Tripping's observed are as follows:

  1.400/220 kV 600 MVA Padghe ICT 4
  2.400 kV Padghe-Boisar
  3.220 kV Padghe-Themgar D/C
  4.220 kV Padghe-Wada
  5.220 kV Padghe-Kamba 2
  6.220 kV Padghe-Jindal
- The Event Report is enclosed at **Annexure 2C.8.**

2C.8.2: Discussion in 136th PCM:

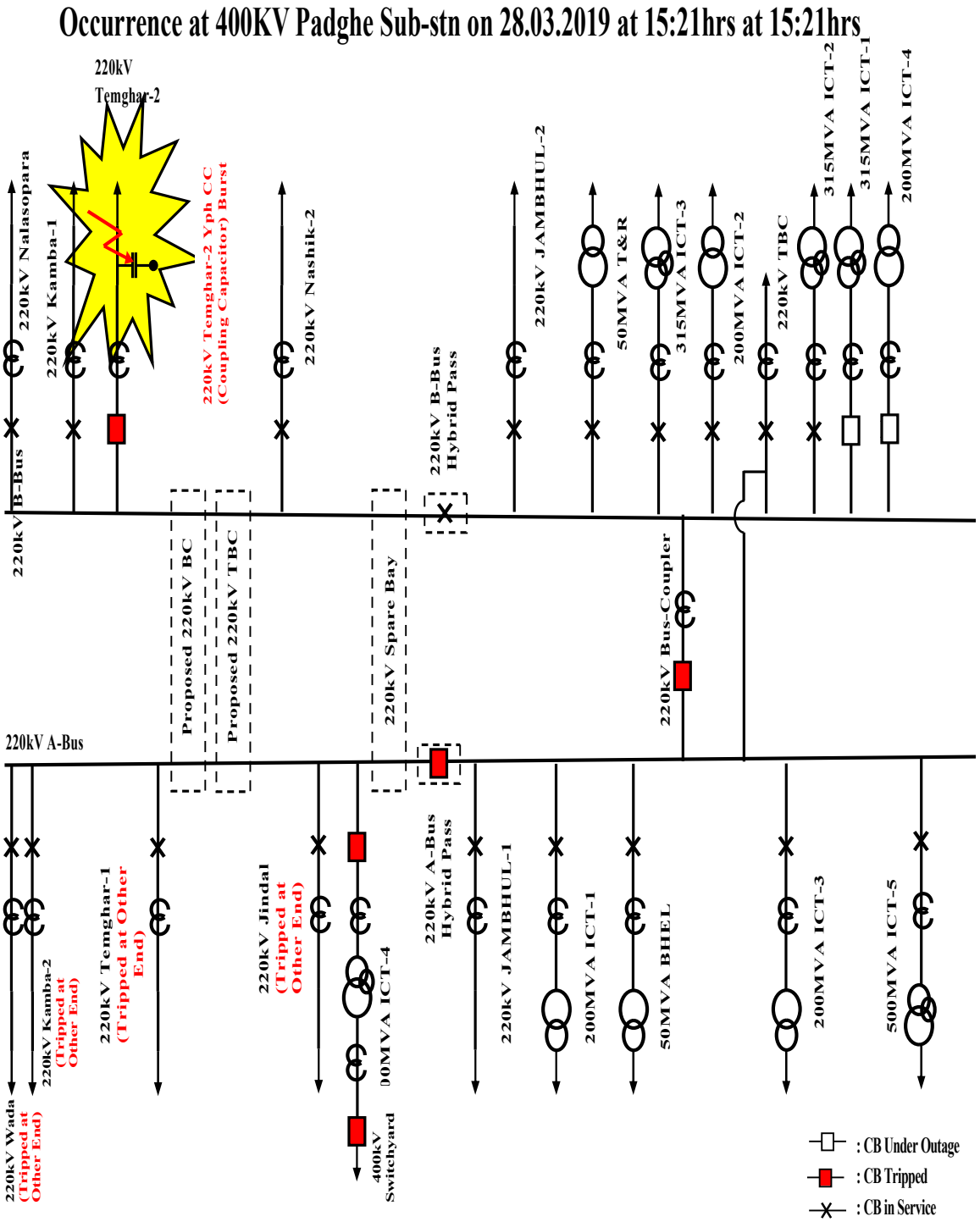
MSETCL representative informed the following;

- On 28.03.2019 at 15.21 hrs there was a grid incidence at 400/220 kV Padghe s/s, Y phase Coupling capacitor of 220 KV Temghar 2 line was busted subsequently caught fire & fumes.
- Busting of Y phase CC caused Y ph to ground fault on Temghar 2 line. Being single phase to earth fault, Y pole of CBs of Temghar 2 line tripped at both ends & fault was cleared in 100ms with operation of AR at both ends.
- After 150ms Bph to earth fault caused on Temghar 2 line by fire & fumes broken conductor and other materials of the bursted CC and it was cleared by distance relay as fault occurred in dead time of AR cycle by tripping other R & B pole of CB. Fault was cleared in correctly in 100msec.
- Further after 1.618 sec, fire and fumes of busted CC reached to the R ph conductor of 220KV A bus causing Rph to Earth fault on A Bus. During this fault, bus bar protection RADSS ABB seemed to remain inoperative (this might be due to nature of fault) hence 220KV bus coupler tripped on back up OC protection after 200 msec and bus

sectionaliser for A bus tripped on back up OC protection after 250 msec as back up to bus bar protection.

- Further 220KV Kamba 2, Temghar 1, Wada, Jindal lines tripped on back up EF or zone 2 protections at remote end after 400 msec. After 460 msec 600MVA ICT 4 tripped on HV back up E/F protection and concerned section of 220KV A bus became dead.

SLD of 400/220 kV Padghe s/sis shown below:-



Remedial measures suggested taken after the incident are as follows :

- Bus Bar Protection RADSS needs replacement by Numeric Protection considering future Bays and addition of 2 nos of bus sectionalizes and future bays as Bus Coupler, TBC.

Committee observed the following:

- Committee observed that the 220 kV Bus A, BB protection was not operated at Padghe end and the R phase Bus fault was persisting around 500 ms and all the elements connected to the bus tripped on Back up/Zone 2 distance protection operation from remote end which was undesirable. Committee requested MSETCL to thoroughly check the non-operation of BB protection during this incidence. Therefore as per MSETCL observation the Bus Bar Protection RADSS needs replacement by Numeric Protection to avoid such non-operation at very important substation like Padghe.
- Committee observed that blasting of Y phase Coupling capacitor of 220 kV Temghar 2 line occurred at Padghe. Zone 1 DPR operated, Y phase trip command was given, carrier was sent to the remote end and auto-recloser was initiated. 400 kV Padghe-Boisar line tripped on Y Phase reverse zone distance protection operation and the tripping was undesirable. After 150 ms, due to fire, fault got extended to B phase, 3 phase trip command was given and auto-reclosure was blocked.
- After 1.6 seconds fault got extended to R phase conductor of bus A creating R phase to ground fault but the BB protection of 220 kV bus 1 was not operated. 220 kV bus coupler and 220 kV Bus A sectionalizer tripped on back up O/C protection. 400/220 kV 600 MVA ICT 4 tripped on O/C protection. 220 kV Padghe-Wada & 220 kV Padghe Kamba 2 tripped on backup protection from remote end only. 220 kV Padghe-Temghar 1 & 220 kV Padghe-Jindal tripped from remote end only on zone 2 distance protection.
- Apart from Bus-bar non-operation, other trippings are appeared to be in order. DR is to be synchronized for time.

Committee noted as above.

2C.9.	Substation:	400 kV Aurangabad(MH) s/s
	Date & time:	03.04.2019 at 17:14 hrs.
	Event Category:	GI-2

2C.9.1: Event Summary:

- On 03.04.2019 at 17.14 hrs there was a grid incidence at 400 kV Aurangabad (MH) s/s.
- At 400 kV Aurangabad (MH), 400 kV Bus 1 bus bar protection operated and all the elements connected to 400 kV Bus 1 tripped.
- At the time of tripping new bus bar relay commissioning/testing work was under progress.
- Tripping from the new bus bar scheme was kept isolated but through the LBB wiring the positive supply got extended to old bus bar scheme and 400 kV Bus 1 tripped.
- Tripping's observed are as follows:
  1. 400 kV Aurangabad(MH)-Deepnagar
  2. 400 kV Aurangabad(MH)-Aurangabad(PG) 2
  3. 400 kV Aurangabad(MH)-Pune 2
  4. 400/220 kV 315 MVA Aurangabad(MH) ICT 1&2
- The Event Report is enclosed at **Annexure 2C.9.**

2C.9.2: Discussion in 136th PCM:

MSETCL representative informed the following;

- At 400kV Waluj S/S work of commissioning of new Bus-bar protection was in progress. CT and isolator status and breaker status was given to new Busbar. Tripping of this busbar was kept isolated.
- However through LBB wiring tripping get extended to old busbar which is in service. Hence tripping occurred.
- Now LBB wiring to new bus bar protection removed and new busbar protection kept in service.

Tripping and restoration of the elements in the ss are as follows:

Name of Feeder/ICT/TF (765/400/220/132/110/100 /66kV)	Occurrence date/ time		Restoration date/time	
	Date	Time	Date	Time
400/220kV 315 MVA ICT-I	03-04-2019	17:14	03-04-2019	18:17
400/220kV 315 MVA ICT-II	03-04-2019	17:14	03-04-2019	18:17
400kV ACPG-II	03-04-2019	17:14	03-04-2019	18:17
400kV Pune-II	03-04-2019	17:14	03-04-2019	18:17
400kV Deepnagar	03-04-2019	17:14	03-04-2019	18:17
400kV Buscoupler	03-04-2019	17:14	03-04-2019	18:17

Committee suggested SOP need to be followed during the installation, testing of the relays at site to avoid similar type of incidents in future.

2C.10.	Substation:	220 kV Borivali s/s.
	Date & time:	08.04.2019 at 01:10 hrs.
	Event Category:	GI-1

2C.10.1: Event Summary:

- On 08.04.2019 at 01.10 hrs there was a grid incidence at 220 kV Borivali s/s.
- At 220 kV Borivali s/s, 220 kV Bus 1 and 2 tripped on Bus bar protection when there was a through fault on 220 kV Borivali-Kalwa.
- 220 kV Tarapur line Y phase CT cable from Marshalling box to the Bus bar relay panel found damaged and replaced with a new one.
- Tripping's observed are as follows:
  1.220 kV Borivali-Kalwa
  2.220 kV Borivali-Khargar 2
  3.220 kV Borivali-Tarapur
  4.220 kV Borivali-TATA 4
  5.220 kV Borivali-Bhandup
  6.220 kV Borivali-AEML Borivali 2
  7.220 kV Borivali-Gorai 2
- The Event Report is enclosed at **Annexure 2C.10.**

2C.10.2: Discussion in 136th PCM:

MSETCL representative informed the following;

Sequence of events observed on 220kV Borivali- Kalwa Line are as follows:

At Borivali end - At 01:10 hrs, R-ph to ground fault occurred on line resulting in AR lockout and CB trip. A/R lockout due to operation of Bus bar protection.

At Kalwa end - AR is successful.

- At 220 kV Borivali s/s, 220 kV Bus 1 and 2 tripped on Bus bar protection when there was a through fault on 220 kV Borivali-Kalwa.
- From the event record and DR of REB500 Busbar relay, it was observed that the busbar relay gave trip commands as BZ01 trip,BZ02 Trip, BBP trip L2 thrice on the same date at different times of 01:10 hrs, 01:46 Hrs & 02:16 hrs.
- **Also all three BB tripping are on through fault condition which are as follows:**

Sr. No.	Time of Operation	Feeder Fault		BB Relay
1	01:10 hrs	220 kV Kalwa Line	Zone 1 Trip, R- Ph Trip, IL1- 18.1kA, In-19.02kA	BZ01 trip,BZ02 Trip, BBP trip L2

2	01:46 hrs	220 kV Boisar -1	Zone 1 Trip, B- Ph Trip, IL3- 23.82kA, In- 23.84kA	BZ01 trip,BZ02 Trip, BBP trip L2
3	02:16 hrs	220 kV Kharghar -1	Zone 1 Trip, Y- Ph Trip, IL2- 18.46kA, In- 19.33kA	BZ01 trip,BZ02 Trip, BBP trip L2

- As REB500 has DR storage facility for one record, only the last fault at time 02:16 hrs record was available.

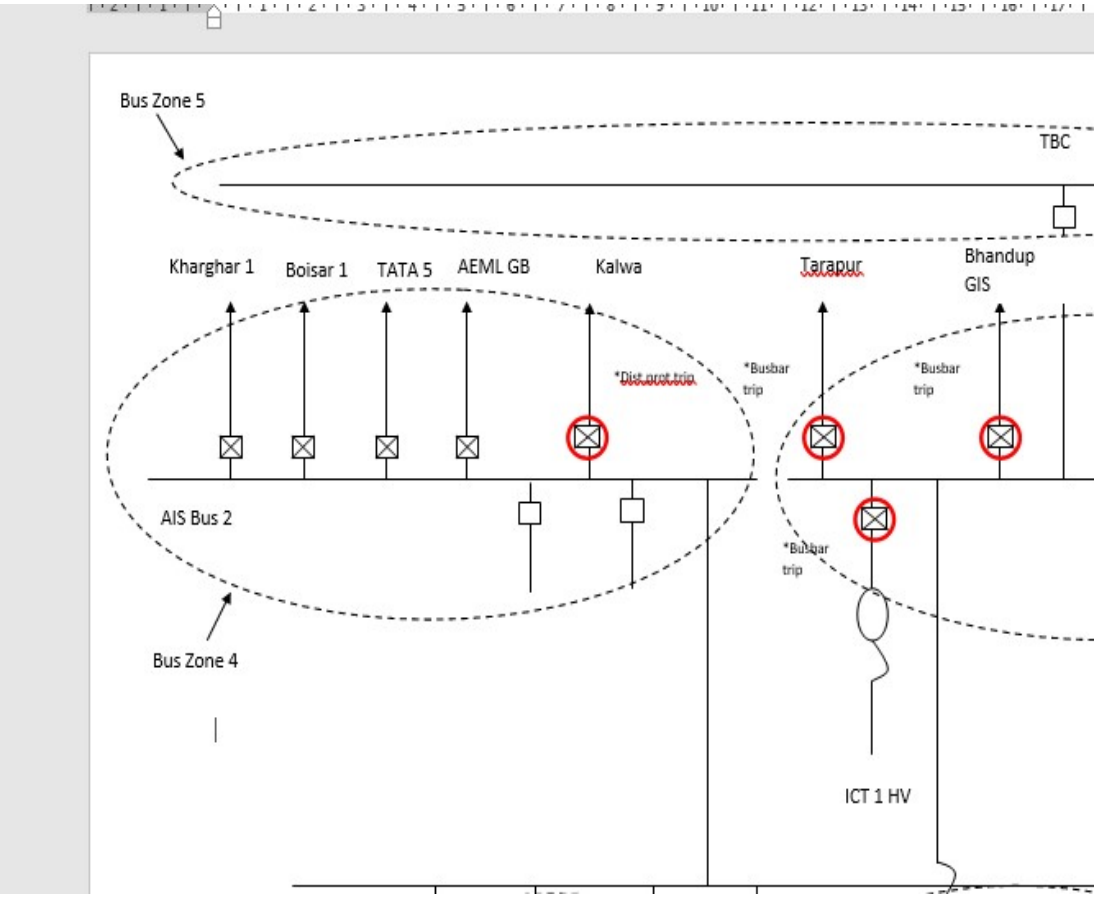
Sequence of events observed on 220kV Borivali- Tarapur line are as follows:

- As per DR of REB500, it is seen that Y ph- E current 9010 A causing Bus Zone-01 and Bus Zone-2 operation. It was suspected that spurious current may have flown in Y Ph bus bar core in CT secondary circuit of Tarapur line, since current seen by Tarapur line distance relay at the time of Kalwa line fault (First BBP through fault) is 1300 A.
- Also from fault data sheet, max 3 phase fault contribution from 220 kV Tarapur line for Borivali bus fault is 1977 A, this increased our doubt that there was spurious current flowing in the Bus Bar CT ckt. of Tarapur line at the time of through fault condition.
- To investigate further, outage was availed on Tarapur line on 12.04.2019.
- It was found that busbar CT cable from CT Mk box to Busbar panel has its Y ph and N wires earthed.
- This was confirmed by conducting IR test of cable and values are:

Description	**Voltage Applied**	**IR Value**	**Voltage Sustained**
R-Armored	500 V	24.8 M ohm	534 V
Y-Armored	500 V	1 K ohm	2 V
B-Armored	500 V	153 M ohm	535 V
N-Armored	500 V	8 K ohm	14 V

- Faulty 4 core CT control cable replaced with cable with IR values above 100 M ohm.

SLD of the 220 kV Borivali s/s is given below:-



Remedial measures taken are as follows:

- CT secondary Control cable failure may be due to potential rise in yard during system faults. Adequate earthling should be provided.

Committee observed the following:

- Committee observed that at 220 kV Borivali s/s, 220 kV Bus 1 and 2 were tripped on Bus bar protection when there was a through fault on 220 kV Borivali-Kalwa. This was a mal operation.
- From the event record and DR of REB500 Busbar relay, it was observed that the busbar relay gave trip commands as BZ01 trip,BZ02 Trip, BBP trip L2 thrice on the same date at different times of 01:10 hrs, 01:46 Hrs & 02:16 hrs.
- MSETCL representative informed that busbar CT cable from CT Mk box to Busbar panel has its Y ph and N wires earthed and also informed that there was spurious current flowing in the Bus Bar CT ckt. of Tarapur line at the time of through fault condition which may resulted in BB operation.

Committee suggested that proper maintenance of equipment and relays may avoid such type of incidents in future and requested MSETCL to follow proper maintenance of equipment in switch yards.

2C.11.	**Substation:**	**400 kV Chandrapur-II s**
	Date & time:	**12.04.2019 at 15:25 hrs.**
	Event Category:	GI-2

2C.11.1: Event Summary:

- On 12.04.2019 at 15.25 hrs there was a grid incidence at 400 kV Chandrapur-II s/s.
- At 400 kV Chandrapur-II s/s, R-phase pole of 500MVA ICT-2 tie breaker blasted, resulting in Bus-1 busbar protection operation.
- As the fault was persistent, LBB of tie bay operated, and Main bay of ICT-2 (on Bus-2) tripped. During the event, Chandrapur Unit-8(500MW) & Unit-9(500MW), and Dhariwal units (2X300MW) tripped causing generation loss of 1421MW (Ex-bus).
- 400kV Chandrapur –Bhadrawati-4 tripped at Bhadrawati end only.
- Tripping's observed are as follows:
  1. 400/220kV Chandrapur-II ICT 2
  2. 400 kV Chandrapur 2 Bus 1
  3. 400 kV Bhadrawathi-Chandrapur IV
  4. 500 MW Chandrapur-II Unit-8
  5. 500 MW Chandrapur-II Unit-9
  6. 300 MW Dhariwal(STU) Unit
  7. 300 MW Dhariwal(CTU) Unit
- The Event Report is enclosed at **Annexure 2C.11.**

2C.11.2: Discussion in 136th PCM:

MSETCL representative informed the following;

- On 12.04.2019 at 15:25:00 Hrs, 400kV R-ph CB pole (SIEMENS make) of Tie bay (Bay 435) of 400/220kV ICT-2 (Bay 436) was burst and resulted in operation of BUS-1 bus bar protection scheme & operation of LBB Protection scheme of TIE Bay (435) at 400kV Chandrapur-2 S/S.

Sequences of events during the occurrence are as follows:-

a) Line tripping & Restoration: -

1. At 15:15 hrs 400/220kV ICT-2 Charged through MAIN CB (Bay 436) & stood ok.
2. At 15:21 hrs ICT-2 TIE Bay (Bay 435) charged and stood ok.
3. After 4 min. i.e. 15:25, Rph CB pole of Bay 435 got burst.
4. All 400kV lines were in service with their respective tie bays.

b) ICT/TF Tripping & Restoration:-

1. 400/220kV ICT-1 Hand tripped due to damage porcelain collar of SYNC CVT.

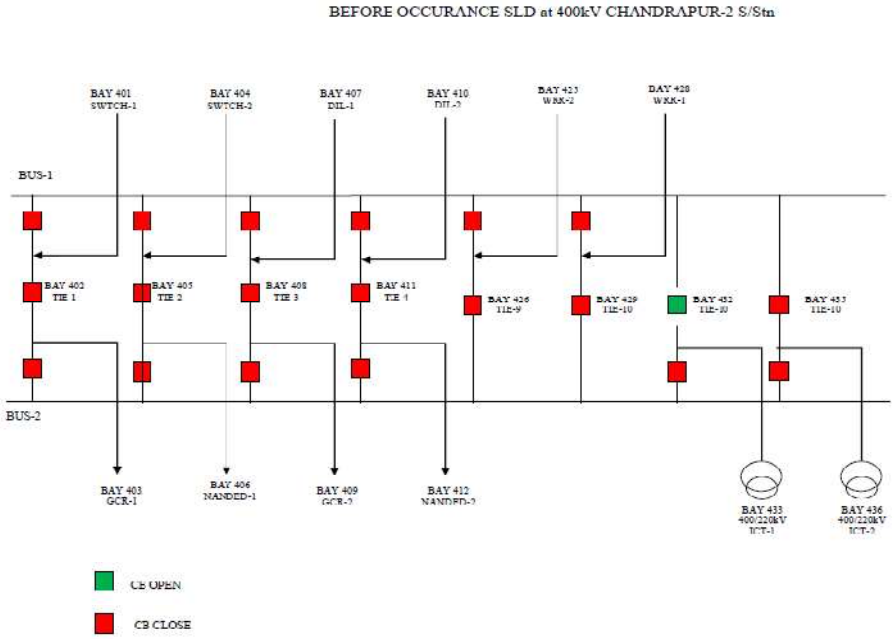
2. 400/220kV ICT-2 tripped due to LBB operation of BAY 435 (TIE BAY).

Relay operations observed: - Relay operation is in order.

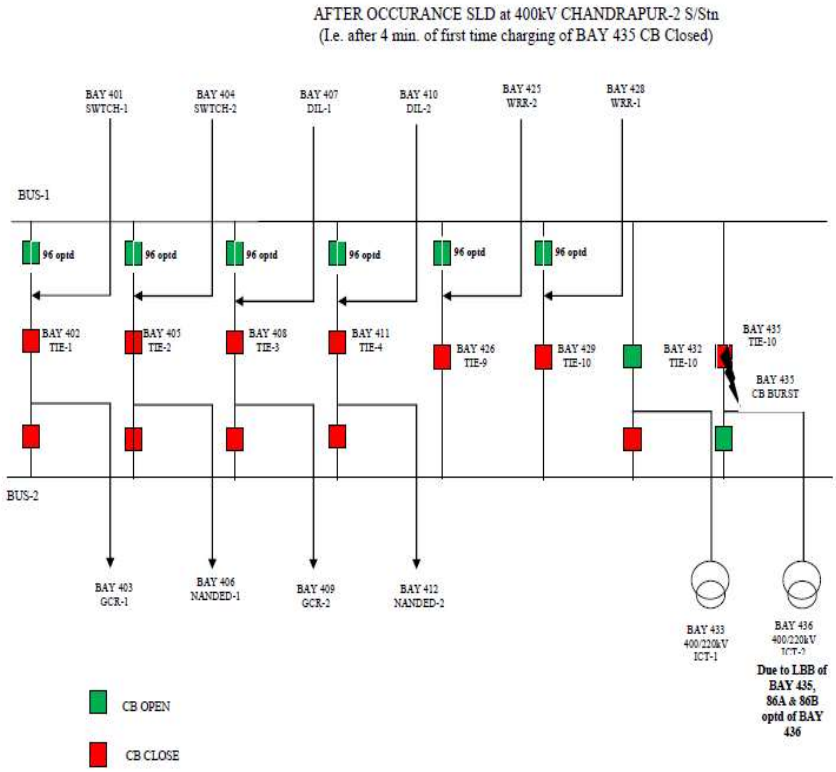
Detailed observation of occurrence as follows:-

- ICT 2 was in charged condition through Bus II Bay No. 436. On 12/04/2019 at 15:21Hrs, the CB of Tie Bay (Bay 435) 400/220kV ICT-2 was first time charged. After 4 mins. i.e. at 15:25 Hrs R-ph pole of CB (Make: Siemens) of Bay 435 was burst.
- Bus-1 bus bar protection scheme & LBB protection scheme of Bay 435 Tie Bay operated. All main CB's connected to BUS-1 tripped on Bus-Bar protection. After the isolation of BUS-1, fault was feed by Bus-2 through Bay 436 (ICT-2 Bay), due to which LBB protection of Bay 435 operated, resulting into tripping of Bay 436 (ICT-2). Total fault duration was 250msec (approx.)
- From physical observation of Rph CB pole, there might be insulation failure of CB. Due to heavy voltage dip, the coal mills at MSPGCL Unit-8&9 were tripped; subsequently drum level failure & also boiler tripped, resulting into Unit-8 & 9 tripping.
- M/s. DIL Unit was tripped on voltage controlled over-current protection. The above information is received from MSPGCL & M/s. DIL respectively. Due to bursting of R-ph pole of CB, the porcelain collar of the bay equipment got damaged (e.g. CT, Sync CVT, CB Grading Capacitor, ISO. BPI). The SYNC CVT of 400/220kV ICT-1 was observed damage (Porcelain collar). The ICT-1 (BAY 433) was in service through MAIN CB on 400kV BUS-2.
- Due to damage porcelain collar of SYNC CVT, ICT-1 hand trip as per LD instruction at 17:10 Hrs. Faulty CB (BAY 435) was isolated from system & 400kV BUS-1 charged at 17:35 hrs as per LD Instruction. The Bay 435 CB prior to charging, test results are found in order and same was forwarded to M/s. Siemens. After getting clearance from M/s.
- Siemens further charging of Bay with due permission of LD was carried out. The pre-charging test reports along with Siemens clearance letter is enclosed herewith.

- **Before the occurrence SLD of 400 KV Chandrapur SS as follows:-**



- **After the occurrence SLD of 400 KV Chandrapur SS as follows:-**



Remedial action taken after the incident as follows:-

1. The matter is taken up with M/s SIEMENS for further analysis & identification of exact reason for failure of CB and corrective action thereof. MSETCL Engineer visited at Siemens factory on dated16.05.2019, Aurangabad for root cause analysis of CB failure.
2. Porcelain collar damaged equipment needs to be replaced or necessary corrective action needs to be taken by SE Project/ EE Project at the earliest.

Committee observed the following:

- Committee observed that Bus-1 bus bar protection scheme & LBB protection scheme of Bay 435 Tie Bay operation was found in order. All main CB's connected to BUS-1 tripped on Bus-Bar protection which was found in order.

Committee requested MSETCL to submit the CB failure analysis report to WRPC at the earliest.

2C.12.	**Substation:**	**400 kV Nagothane s/s**
	Date & time:	**13.04.2019 at 22:50 hrs.**
	Event Category:	GI-2

2C.12.1: Event Summary:

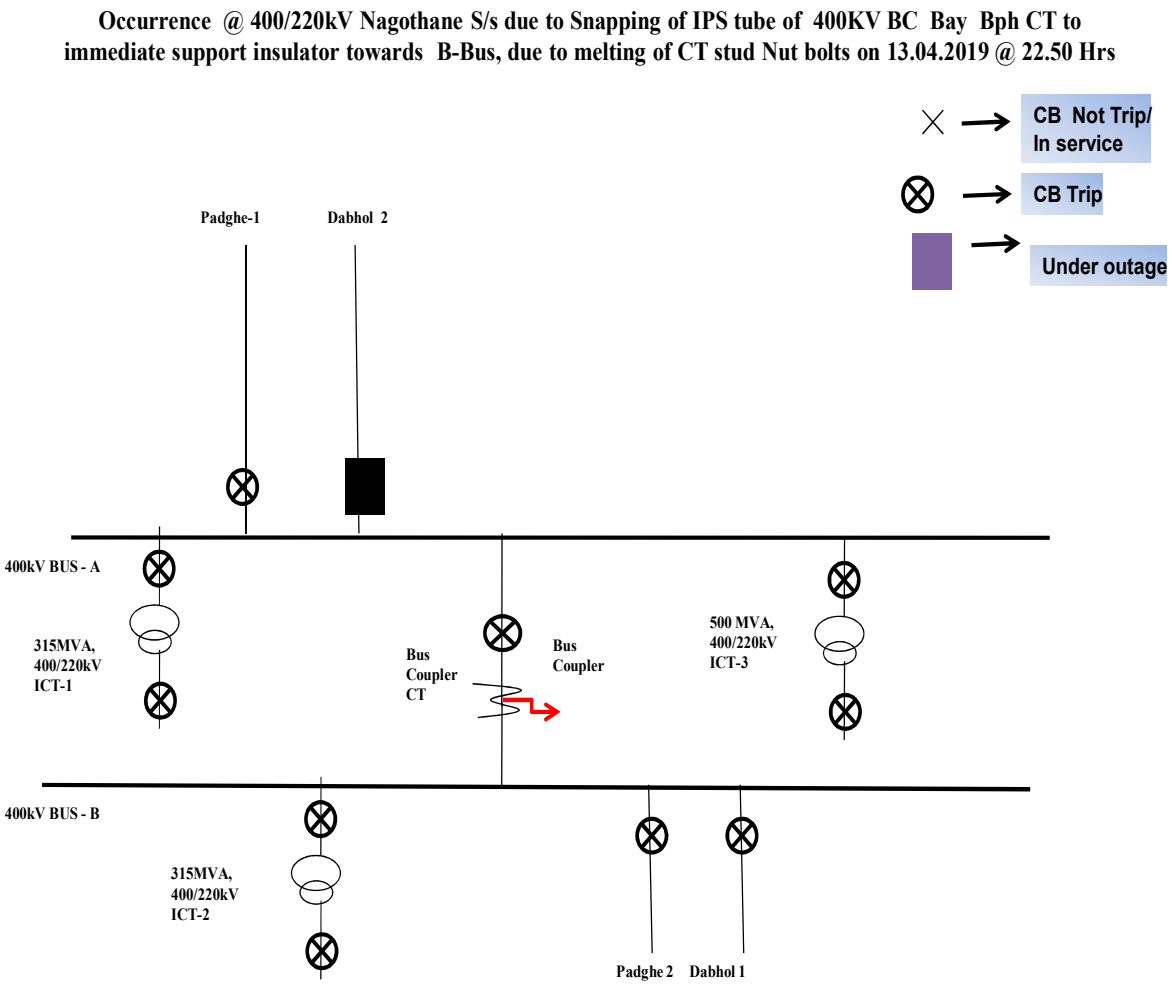
- On 13.04.2019 at 22.50 hrs there was a grid incidence at 400 kV Nagothane s/s.
- At 400 kV Nagothane s/s, Bus coupler bay, IPS Tube between B-ph CT and 400 kV Bus 2 fell down and created B phase fault.
- 400 kV Bus 1,2 and all its connected elements tripped on Bus bar protection operation.
- Tripping's observed are as follows:
  1.400 kV Nagothane-Padghe 1&2
  2.400 kV Nagothane-Dhabol 1
  3.400/220 kV 315 MVA Nagothane ICT 1&2
  4.400/220 kV 500 MVA Nagothane ICT 3
  5.400 kV Nagothane Bus coupler
- The Event Report is enclosed at **Annexure 2C.12.**

2C.12.2: Discussion in 136th PCM:

MSETCL representative informed the following;

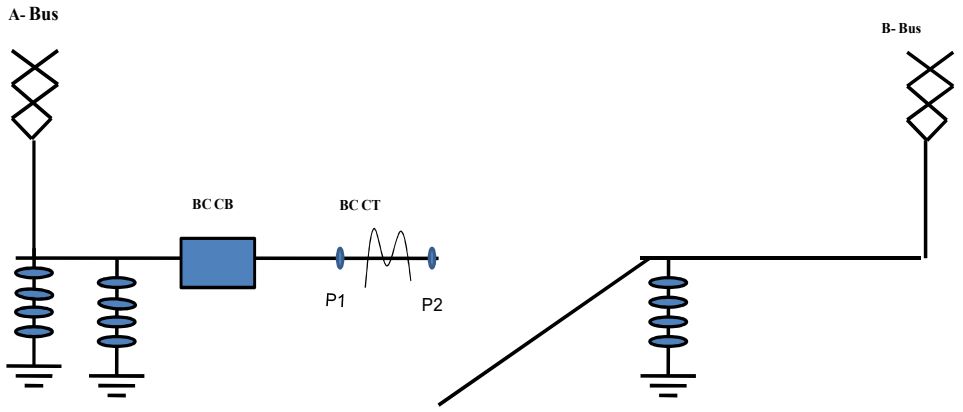
- On 13.04.2019 at 22:50 hrs, IPS Tube between B-ph CT and B-bus fallen down due to melting of Nut Bolts of clamps of CT stud of 400kV Bus-coupler Bay.
- Hence Bus-Bar Zone A protection and Bus-Bar Zone B protection operated.
- All loads on 220KV side are managed by 220KV ACCIL & 220KV POSCO lines.

SLD of the 400 kV Nagothane s/s at the time of occurrence as follows:-



Occurrence @ 400/220kV Nagothane S/s due to Snapping of IPS tube of 400KV BC Bay Bph CT to immediate support insulator towards B-Bus, due to melting of CT stud Nut bolts on 13.04.2019 @ 22.50 Hrs

Horizontal configuration of B phase of 400KV Bus Coupler



Remedial Measures taken are as follows:

- Instructed to carry out Thermography of all joints on 400KV & 220KV side bays regularly and precisely to avoid such occurrence in future.

Committee observed the following:

- MS enquired whether thermo vision scanning for hot spots was carried out on the substation equipment.
- MSETCL representative informed that thermo vision scanning for hot spots was carried out on the substation equipment but did not found any hot spots in and around the failed equipment.
- The operation of bus bar protection was found in order.

Committee suggested proper maintenance of substation equipment may help in reducing similar type of incidents in future.

2C.13.	**Substation:**	**400 kV Parli(MH) s/s**
	Date & time:	**29.04.2019 at 18:07 hrs.**
	Event Category:	GI-2

2C.13.1: Event Summary:

- On 29.04.2019 at 18.07 hrs there was a grid incidence at 400 kV Parli(MH) s/s.
- At 400 kV Parli(MH) s/s, Y phase CT of 400 kV Chandrapur blasted and resulted in tripping of all the elements connected to 400 kV Bus 2 on Bus bar protection operation.
- Tripping's observed are as follows:

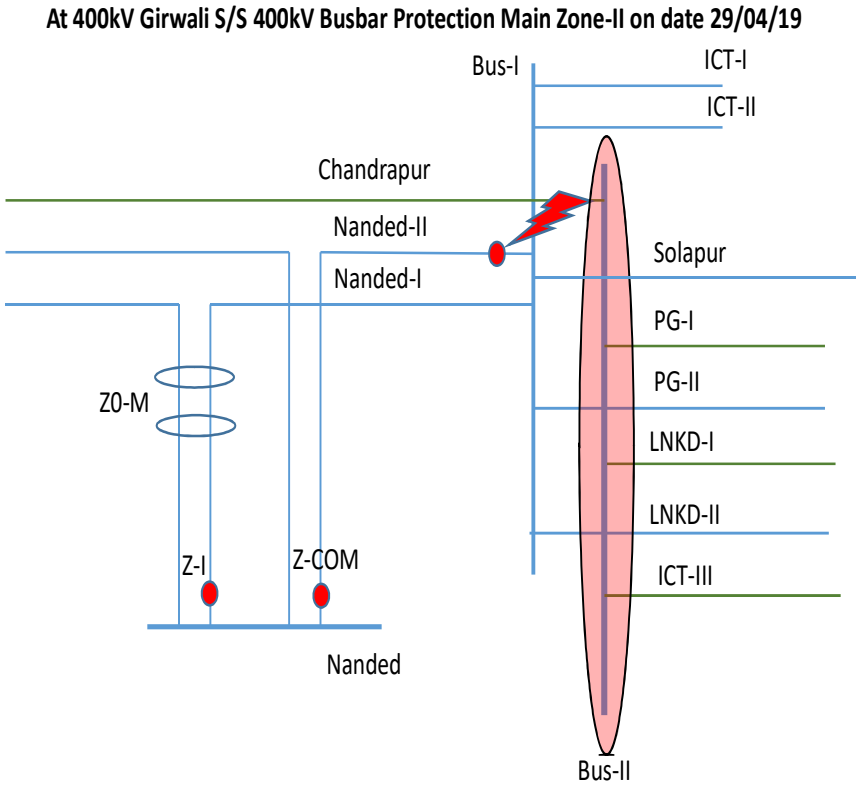
  1.400 kV Parli(MH)-Lonikhand 1
  2.400 kV Parli(MH)-Nanded 1&2
  3.400 kV Parli(MH)- Chandrapur
  4.400 kV Parli(MH)-Parli(PG)
  5.400/220 kV Parli(MH) ICT 3
- The Event Report is enclosed at **Annexure 2C.13.**

2C.13.2: Discussion in 136th PCM:

MSETCL representative informed the following;

- At 400kV Girwali S/S, CT of Chandrapur line B-Ph CT burst on date 29/04/19 at 18:08 Hrs. Chandrapur – Girwali line was connected to bus – II. This resulted into operation of Busbar protection Zone-II.
- All elements connected to Bus-II operated correctly.
- In addition to this there is remote end tripping of Nanded-Girwali Ckt-I and Ckt-II on operation of distance protection Z-1. During this operation Generation and load affected is Nil.
- 400kV Chandrapur bay B-Ph CT was commissioned in 1991 and the make of the CT was WS. Though it has no tan-d point; it has measured and found to have value about 0.35%.
- Due to bursting of this CT; Bus-II protection of 400kV Girwali operated correctly.
- But along with this due to smoke of this CT on 400kV Nanded-II bay CTs; which is adjacent to Chandrapur bay; this line tripped from both ends on distance protection.
- Due to line configuration and mutual inductance distance relay of Nanded-Girwali Ckt-1 overreached and tripped on distance protection Zone-I from Nanded end only.
- Distance reach setting of Nanded-Girwali CKT-I & II being reviewed.

SLD and analysis of occurrence is as follows:



Committee observed the following:

- Committee observed that at 400kV Girwali S/S, CT of Chandrapur line B-Ph CT burst and at the time Chandrapur – Girwali line was connected to bus – II. This resulted into operation of Busbar protection Zone-II. The operation of Busbar protection Zone-II was found in order.
- In addition to this there is remote end tripping of Nanded-Girwali Ckt-I and Ckt-II on operation of distance protection Z-1.

Committee suggested that proper maintenance of equipment may avoid such type of incidents in future and requested MSETCL to follow proper maintenance of equipment in switch yards.Committee requested MSETCL to submit the CT failure analysis report to WRPC at the earliest.

2D.Occurrences in Goa system:

2D.1.	**Substation:**	**220kV Ponda s/s**
	Date & time:	**25.11.2018 at 06:01 hrs.**
	Event Category:	GI-1

2D.1.1: Event Summary:

- On 25.11.2018 at 06.01 hrs there was a grid incidence at 220kV Ponda s/s.
- At 220kV Ponda s/s, 220 kV Mapusa-Ponda 1 and Amona-Ponda 1 tripped due to CT failure of 220 kV Amona-Ponda 2 at Ponda end.
- Trippings observed are as follows:
  - 220 kV Mapusa-Ponda 1
  - 220 kV Amona-Ponda 2
  - 220 kV Mahalakshmi-Amona
- The SLD/Event Report is enclosed at **Annexure 2D.1**

2D.1.2: Discussion in 136thPCM:

Committee observed that Goa representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2D.2.	**Substation:**	**Grid incident at Amona S/s**
	Date & time:	**19.02.2018 at 06.45 hrs.**
	Event Category:	GI-2

2D.2.1: Event Summary:

- On 19.02.2018 at 06.45 hrs there was a grid incidence at Amona s/s.
- R phase LA of 220 kV Amona-Ponda 2 burst at Ponda end and the CB at Amona end did not trip during the event.
- This resulted in LBB operation of 220 kV Amona-Ponda 2 and tripping of 220 kV Tillari and Mahalakshmi feeders and ICTs connected to 220 kV Bus 2 at Amona S/s.
- Trippings observed are as follows:
  - 220 kV Tillari-Amona
  - 220 kV Mahalakshmi-Amona
  - 220 kV Amona-Ponda 2
  - 220/132 kV 100 MVA Amona ICT(BHEL)
  - 220/132 kV 100 MVA Amona ICT(CGL)

The Event report is enclosed as **Annexure 2D.2**.

2D.2.2: Discussion in 136thPCM:

Committee observed that Goa representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2E.Occurrences in Chhattisgarh system:

2E.1.	**Substation:**	**220 kV Urla s/s**
	Date & time:	**26.01.2019 at 04:14 hrs.**
	Event Category:	GD-1

2E.1.1: Event Summary:

- On 26.01.2019 at 04.14 hrs there was a grid incidence at 220 kV Urla ss.
- At 220 kV Urla s/s, R phase tension insulator of Aux bus failed and conductor snapped which resulted in tripping of all the elements in 220 kV Bus on Bus bar protection operation.
- 220 kV Urla s/s got black out and the downstream Kachna, Birgaon and Hira pooling area got affected due to the event.
- Trippings observed are as follows:

  1.220/132 kV 160 MVA Urla ICT 1,2&3
  2.400KV Raita-KhedamaraHEDAMARA 2&3
  3.220KV Urla-Raipur
  4.220KV Urla- Raita
  5.220KV Urla-Borjhara
  6.220KV Urla –Siltara
- The SLD/Event Report is enclosed at **Annexure 2E.1**

2E.1.2: Discussion in 136thPCM:

Committee observed that CSPTCL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2E.2.	**Substation:**	**400/220 kV Korba(W)**
	Date & time:	**06.02.2019 at 22:00 hrs.**
	Event Category:	GI-1

2E.2.1: Event Summary:

- On 06.02.2019 at 22.00 hrs there was a grid incidence at 400/220 kV Korba(W) substation.
- At 400/220 kV Korba(W) substation,While charging 400 kV Korba(W)-Marwa all the other 400 kV lines at Korba(W) tripped on Over Voltage.
- 210 MW Korba(W) Units 3&4 also tripped during the event.
- Trippings observed are as follows:

  1. 400 KV Korba (W)-Marwa Ckt.
  2. 400 KV Korba (W)-Raita Ckt.
  3. 400 KV Korba (W)-Bhilai Ckt.
  4. 210 MW Korba(W) Unit 3&4
- The SLD/Event Report is enclosed at **Annexure 2E.2**

2E.2.2: Discussion in 136thPCM:

Committee observed that CSPTCL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2F.Occurrences in Dadra and Nagar Haveli system:

2F.1.	**Substation:**	**220 kV Khadoli S/s**
	Date & time:	**27.10.2018 at 17:00 hrs.**
	Event Category:	GI-1

2F.1.1: Event Summary:

- On 27.10.2018 at 17.00 hrs there was a grid incidence at 220 kV Khadoli s/s.
- At 220 kV Khadoli S/s, during primary injection testing at CT of 66 kV Khadoli -Khadoli -3, 66 kV side elements tripped on LBB operation.
- Trippings observed are as follows:
    - 220/66 kV 160 MVA Khadoli ICT 1
    - 220/66 kV 160 MVA Khadoli ICT 2
    - 66 kV feeders at Khadoli s/s
- The SLD/Event Report is enclosed at **Annexure 2F.1**

2F.1.2: Discussion in 136thPCM:

Committee observed that DNH representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2F.2.	**Substation:**	**220/66 kV Bhilosa s/s**
	Date & time:	**22.11.2018 at 11:56 hrs.**
	Event Category:	GI-1

2F.2.1: Event Summary:

- 220/66 kV Bhilosa ICTs 1&2 tripped on differential protection operation.
- Trippings observed are as follows:
    - 220/66 kV Bhilosa ICT 1
    - 220/66 kV Bhilosa ICT 2
- The SLD/Event Report is enclosed at **Annexure 2F.2**

2F.2.2: Discussion in 136thPCM:

Committee observed that DNH representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2F.3.	**Substation:**	**Kharadpada substation**
	Date & time:	**03.09.2018 at 09.20 hrs.**
	Event Category:	GI-1

2F.3.1: Event Summary:

- 220/66 kV ICTs at Kharadpada substation tripped only on HV side on master trip relay operation and all the 66 kV side elements tripped during the event.
- Trippings observed are as follows:
  - 220/66 kV 160 MVA Kharadpada ICT 1&4
  - 220/66 kV 100 MVA Kharadpada ICT 2&3

The SLD/Event Report is enclosed at ***Annexure 2F.3.***

2F.3.2: Discussion in 136th PCM:

Committee observed that DNH representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2G.Occurrences in Daman and Diu system:

Nil

2H.Occurrences in PGCIL systems:

2H.1.	**Substation:**	**765/400 kV Durg s/s**
	Date & time:	**23.01.2019 at 13:58 hrs.**
	Event Category:	GI-2

2H.1.1: Event Summary:

- At 765/400 kV Durg s/s, during the testing of Busbar/LBB protection relay, external LBB initiation extended due to the wrong configuration in Bus bar central unit programmable scheme logic and resulted in tripping of all the elements connected to 765 kV bus 2.
- Prior to the event 765 kV Bus 1 was under planned shutdown.
- Trippings observed are as follows:

  1.765/400 kV 1500 MVA Durg ICT 1&2
  2.765 kV Durg-Champa 2
  3.765 Durg-Wardha 3
  4.765 kV Durg-Wardha 2

- PGCIL may give details in the PCM.

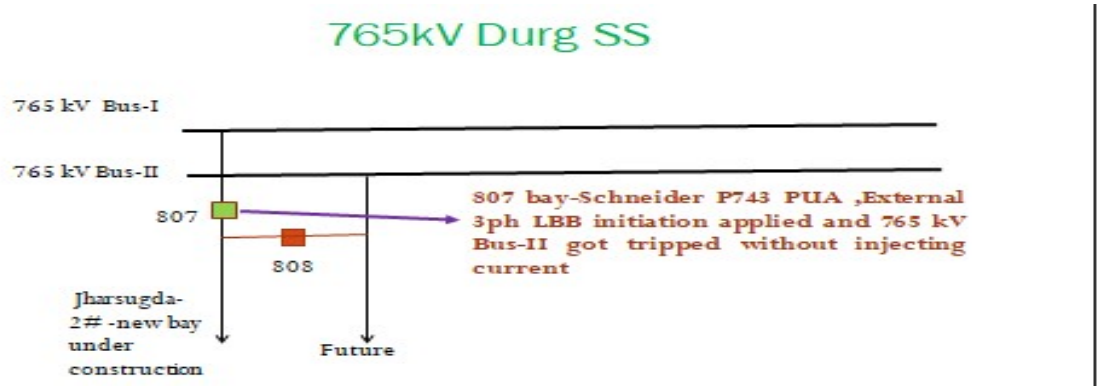
The SLD/Report is enclosed at ***Annexure 2H.1***

2H.1.2: Discussion in 136th PCM:

PGCIL representative informed the following;

- 765 kV Bus-1 at Durg SS was under shutdown for physical connection of extension bays of 765 KV Jharsuguda # 1&2 on dated 23.01.2019.
- While Busbar/LBB protection configuration and testing of 765 kV Jharsugda-2 bay Busbar relay PU's The following elements at Durg SS tripped/Isolated .

1. 765 kV Bus-2 tripped.
2. 765/400 kV ICT-1.(Half DIA.)
3. 765/400 kV ICT-2.(Half DIA.)
4. 765 kV Wardha-4 LR charged as BR isolated(Half DIA).
5. 765 kV Wardha-1 & 3 tripped on over-voltage.
6. 765 kV Kotra-2 & Champa-2 lines isolated due to tripping of Wardha1 &3 being in same dia.
7. 765 kV Bus Reactor isolated (As Kotra-1 line in BR DIA was under shutdown).



- 765 kV Bus-1 was under shutdown. For Testing of LBB protection of 807 Jharsugda-2 main bay, As per scheme, external 3-ph LBB initiation though opto input 7 no was applied to Main 1 Schneider P743 PUA BB/LBB relay of 807 bay.
- After getting initiation and without injecting current, 765 kV Bus-II got tripped.
- 765 kV Bus-1 shutdown availed by opening all BUS-1 connected CB's.
- 807 Jharsugda-2 Bus-1 connected main bay - Schneider P743 PUA LBB protection testing planned. As per scheme, opto input 7 of said P743 relay found assigned and wired for external 3-ph LBB initiation.
- For Testing of LBB protection of 807 Jharsugda-2 main bay external 3-ph LBB initiation applied to Main 1 Schneider P743 PUA BB/LBB relay of 807 bay through DC positive extension to opto - input 7 no of said relay .
- Immediately it was observed that 765 kV Bus-II got tripped.
- Inadvertent tripping of 765 kV Bus-2 after applying ext. 3ph LBB initiation to Bus-1 connected 807 Main bay P743 PUA .
- As configured in PUA PSL, after applying external 3ph LBB initiation through opto input 7 to 807 bay PUA, PU>CU signal 03 got generated .
- As per configuration of CUA PSL(Refer slide no 7), PU>CU signal 03 was assigned for Ext Trip 50BF z2 i.e. BUS-2 tripping.
- Hence, as per above mentioned wrong PSL configuration , on receipt of PU>CU signal 03 from 807 PUA to CUA, 765 kV Bus-2 got tripped.

Corrective actions recommended after the incident are as follows:-

- The relay settings/configuration/scheme/topology shall be strictly verified by Powergrid Engineer at site before proceeding for testing.

Committee observed the following:

- Committee observed that from the PMU plot, there was no fault in the system and the tripping was an undesired operation due to negligence during commissioning and testing.
- WRLDC representative informed that the event was very serious and caused threat to grid security as outage was availed for bus –I at Durg and due to the absence of thorough checking during commissioning of new bay, many elements from bus-II tripped due to incorrect relay settings. PGCIL was requested to enforce more stringent measures to follow standard procedure for ensuring proper check during commissioning of new elements.
- Committee informed that similar types of incidents were reported in the last PCM also. Committee suggested PGCIL to follow standard procedure for ensuring proper check during commissioning of new elements.
- MS,WRPC informed that adequate training of maintenance staff and proper monitoring by senior team is suggested to avoid such unwanted events.

- **Committee suggested the following:**
    - **checking of relay settings may be done at other substations to avoid recurrence of similar events in future.**

2H.2.	**Substation:**	**400/220 kV Bhachau s/s**
	Date & time:	**22.01.2019 at 11:55 hrs.**
	Event Category:	GI-1

2H.2.1: Event Summary:

- At 400/220 kV Bhachau s/s, 220 kV Bus 1 tripped during wiring work between 220kV Ostro kutch#2 panel (existing) to New bays panel (under construction).
- During the work trip command extended to 220kV Bus#1 at Bhachau S/s resulting in tripping of all the elements connected to 220kV Bus 1.
- Prior to the event 765 kV Bus 1 was under planned shutdown.
- Trippings observed are as follows:

    1.220KV Bhachau-Ostro 1
    2.220KV Bhachau-Charadvad 2
    3.220KV Bhachau-Lalpar
    4.400/220KV 315 MVA Bhachau ICT1
- PGCIL may give details in the PCM.

The SLD/Report is enclosed at ***Annexure 2H.2***

2H.2.2: Discussion in 136th PCM:

PGCIL representative informed the following;

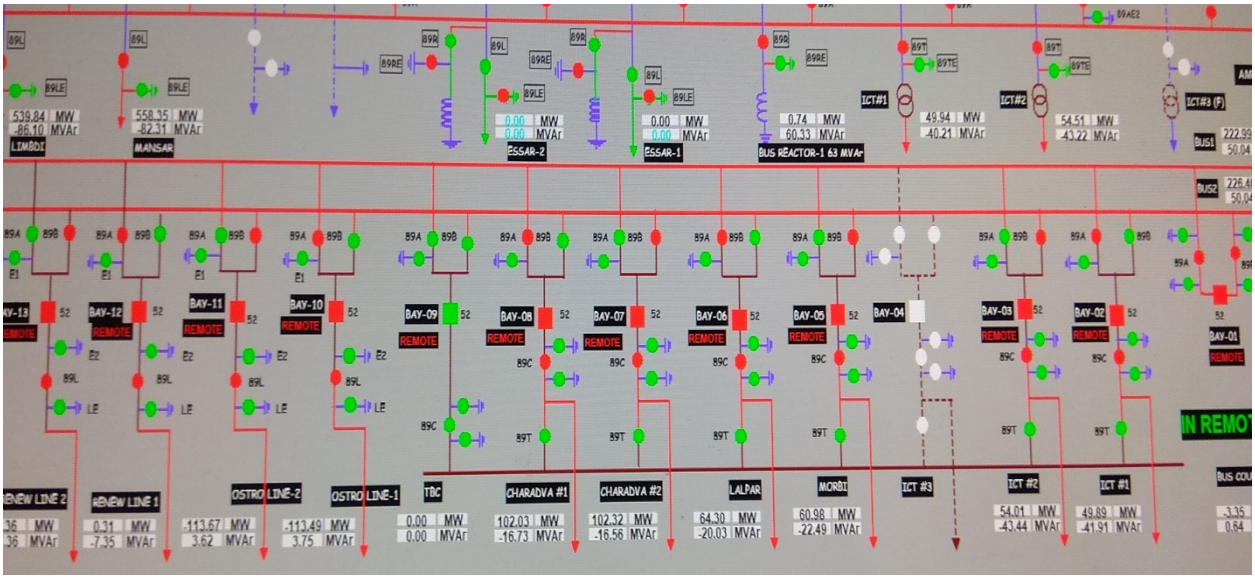
- On 22/01/19 at 11:55 hrs, 220kV Bus#1 got tripped. Due to this, following feeders were tripped: -
    1. 220KV Bhachau-Ostro 1
    2. 220KV Bhachau-Charadava 2
    3. 220KV Bhachau-Lalpar
    4. 400/220KV 315 MVA Bhachau ICT 1

Indications of trippings during the event are as follows: -

- Bus#1 got tripped on SF6 Zone trip signal (indicating Loss of gas in Bus Compartment) of 220kV Ostro#2 Bay.
- Bhachau S/s is mix of AIS & GIS type. At Bhachau, 220kV GIS bays are owned by Wind Power developers (M/s Renew Power). In order to achieve, tripping on loss of SF6 gas due to heavy leakage, SF6 Zone tripping is implemented to avoid flashover in GIS modules.
- Accordingly, SF6 Zone trip signal of Bus modules is wired to Busbar relays for immediate tripping of respective Bus.
- This Bay Extension work was being carried out by M/s Renew Power related to 220kV Bhuvad Bays.

- On analyzing the occurrence, it has been found out that Tripping had occurred during wiring work between 220kV Ostrokutch#2 panel (existing) to New bays panel (under construction).
- DC got extended on Binary input of 220kV Busbar Protection used for SF6 zone trip signal. This has resulted in tripping of the feeders connected on 220kV Bus#1.
- In this regard, it is to mention here that permission was given for laying of the cable only. However, tripping has occurred during dressing of Control cable in existing panel by M/s Renew Power.

SLD of 400/220 kV Bhachau s/s is given below:



Remedial measures taken after the incident are as follows:-

- It has been instructed to M/s Renew Power that any work in live panels is be done by experienced engineer / technician and in presence of personnel from M/s Renew Power. Also, detailed work schedule is to be submitted to POWERGRID for necessary approval.

Committee observed the following:

- MS,WRPC asked whether PGCIL representative was monitoring the execution of works going on in the switch yard and also expressed concern over the lack of proper monitoring of the works going in the 765KV SS.
- PGCIL representative informed that it has been instructed to M/s Renew Power that any work in live panels is be done by experienced engineer / technician and in presence of personnel from M/s Renew Power.

Committee suggested proper monitoring/supervising of construction activities might have avoided this occurrence and requested PGCIL to submit the action taken report to PCM at the earliest.

2H.3.	**Substation:**	**765/400 kV Vadodara s/s**
	Date & time:	**30.01.2019 at 15:00 hrs.**
	Event Category:	GI-2

2H.3.1: Event Summary:

- 765 kV Vadodara-Dhule tripped at Vadodara end only due to DC earth leakage along with Main and Tie bays of 765/400 kV 1500 MVA ICT 3, B/R and Main bay of 765/400 kV 1500 MVA ICT 2.
- Prior to the event 765 kV Bus 1 was under planned shutdown.
- Trippings observed are as follows:
  1. 765 kV Vadodara-Dhule
  2. Main and Tie bays of 765/400 kV 1500 MVA Vadodara ICT 3 and 765 kV 240 MVAR B/R
  3. Main bay of 765/400 kV 1500 MVA Vadodara ICT 2
- PGCIL may give details in the PCM.

The SLD/Report is enclosed at ***Annexure 2H.3***

2H.3.2: Discussion in 136th PCM:

PGCIL representative informed the following;

- Outage of Main Bay (701) of 765kV Vadodara Dhule was taken at 10:10hrs for AMP works. Timing test of the Circuit Breaker was going on and while doing Close-Open (CO) operation following Circuit Breakers tripped: -

Sr. No.	Bay Detail	Feeder detail	Phase tripped	Trip Time	Remarks
1.	708 Tie Bay	765kV Bus Reactor	Y Ph	15.00.51	Subsequently, other 2 phases of the CBs tripped on Pole Discrepancy
2.	702 Tie Bay	765kV Vadodara Dhule & 765kV ICT#1	R Ph	15.00.51	
3.	709 Main Bay	765kV ICT#3 (Future)	Y Ph	15.00.53	
4.	707 Main Bay	765kV Bus Reactor	R Ph	15.00.53	
5.	706 Main Bay	765kV ICT#2	R Ph	15.00.55	

Subsequently the following elements were tripped

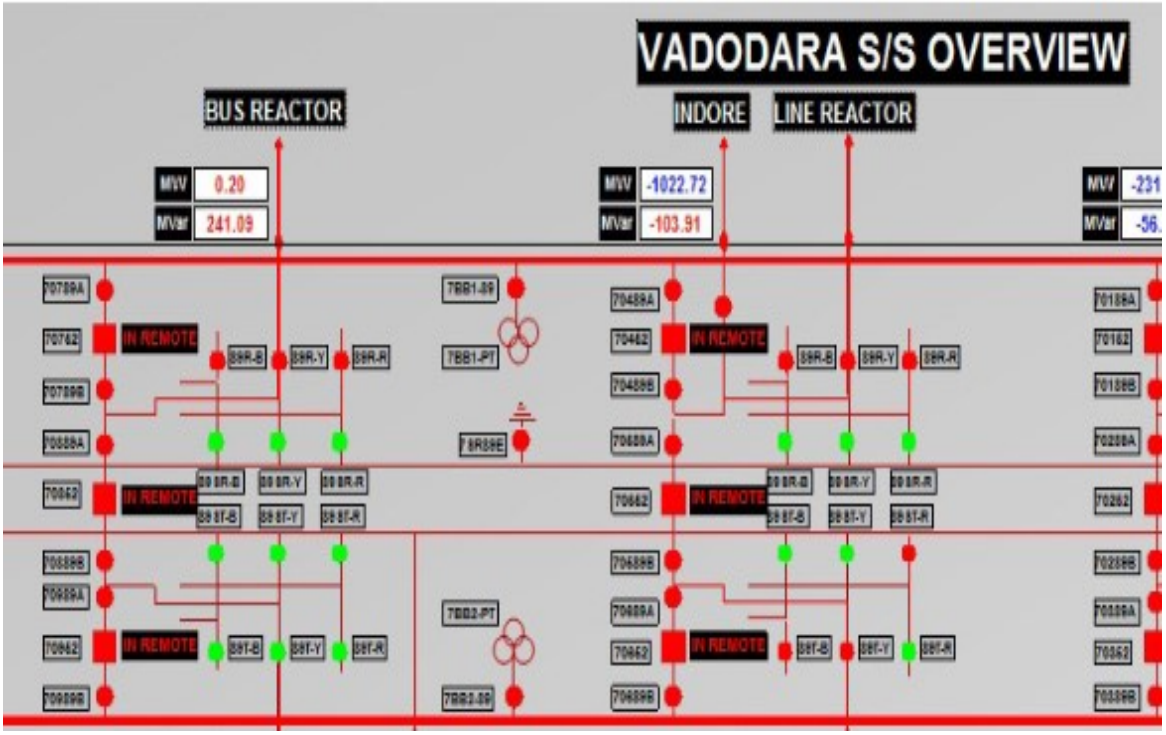
1. 765kV Vadodara Dhule Line tripped from Vadodara.
2. 765kV Bus Reactor got tripped.

- During the occurrence it was observe that no protection signal was recorded.
- It was found out that DC earth fault was recorded in DC-1 & DC-2 at 15:00:16:030 hrs and 15:00:16:053 hrs respectively. After 35 sec of that, tripping of CB poles started. During voltage measurement, DC mixing was found out between the sources.
- DC mixing along with earth fault was traced out in R Ph (of Trip-2) in 706 & 707 Bay and Y Ph (of Trip-1) in 709 Bay were found latched in these CSDs. Further, mixing between Trip 1 & Trip 2 terminals of the CSDs

installed in the aforementioned bays was found due to additional factory wiring.

- Later on DC earth fault was traced in 701 CB operation lockout alarm circuit of B Pole.

SLD of 765/400 kV Vadodara s/s is given below:



Remedial measures taken after the event are as follows:-

- It was observed that DC earth fault in 701 CB has caused earth fault and latching of CSD contacts have increased the voltage across the trip coil (due to mixing) and caused tripping of the respective CB poles.
- Sites have been asked to monitor DC mixing in addition to DC earth fault regularly.

Committee observed the following:

- Committee observed that from the PMU plot, there was no fault in the system and the tripping was an undesired operation due to wrong wiring and DC Earth leakage.
- Committee requested PGCIL to check whether the same problem is existing in other substations in CSDs wiring.

Committee suggested increasing the frequency of maintenance activities for thoroughly checking for any loose connection in control circuit wiring may help in avoiding similar type of occurrences in future and requested PGCIL to submit the action taken report to PCM at the earliest.

2H.4.	**Substation:**	**800 kV HVDC Champa-Kurukshetra terminal**
	Date & time:	**07.02.2019 at 21:40 hrs.**
	Event Category:	GI-2

2H.4.1: Event Summary:

- 800 kV HVDC Champa-Kurukshetra BI-Pole tripped due to TOVC (Transient Overvoltage correction) operation at Kurukshetra end.
- Trippings observed are as follows:
  1. 800 kV HVDC Champa-Kurukshetra Pole 1
  2. 800 kV HVDC Champa-Kurukshetra Pole 2
- PGCIL may give details in the PCM.

  The SLD/Report is enclosed at ***Annexure 2H.4***

2H.4.2: Discussion in 136th PCM:

PGCIL representative informed the following;

- Initial Conditions: Bi-pole 1000MW .Pole-2 850MW and Pole-1 150MW.

6.2 Overvoltage

6.2.1 Transient and Temporary Overvoltage

The equipment is protected against transient and temporary overvoltages by surge arresters and converter control. The converter control shall act to limit the voltage stress.

6.2.2 Long Term Overvoltage

The primary action used for overvoltage is to try to reduce the voltage stress by control actions. The control action to limit long term voltage stress are converter dynamic control, tap changer control and reactive power control detailed in the control specification [1].

Should this not be sufficient to alleviate the overvoltage the protections in Table 10 below will detect and act upon overvoltage.

Table 10 - AC Overvoltage

FAULT	Protection	Remarks
Valve Side Overvoltage	Tap Limits	Will inhibit controls from tapping up to increase the voltage stress and if necessary force the tapchanger to tap down via hardwired signal. The settings of this protection shall not interfere with normal tap changer control
	AC Overvoltage Valve Side	
Line Side Overvoltage	AC Overvoltage Line Side	This protection operates due to overvoltage on the busbar
	Main Capacitor Overvoltage Protection	Trips the filter CB
DC Overvoltage	DC Overvoltage	Tap down & trip on extreme cases

- 21:37:00:00 Number of Filters at Kurukshetra(3A+1B i.e. HACQ 11,21,31 ,12). Pole-2 Power is 850MW.
- 21:37:43:262 Pole-1 deblocked @ 150 MW. Hence Bipole power is now 1000 MW. But AC side voltage at Kurukshetra end was more than rated voltage level.(434kV)
- 21:37:43.263 TOVC operated hence RPC issued command to swich out HACQ 31(A Type Filter).
- To maintain Bipole power of 1000 MW, either 3A +1B OR 2A+2B is required. Hence RPC issued command to close HACQ 22.
- 21:37:56.074 RPC issued command to switch in in HACQ 22. Hence filter energized are 2A+2B.

- 21:38:22:932 TOVC operated again
- 21:39:28.465 HACQ 12 switched out.
- 21:39:34.269 TOVC operated again and HACQ 21 was switched out. Now filter configuration is 1A+1B.
- Bi-pole blocked due to TOVC operated and minimum filter required to run bi-pole was switches.
- In case of AC side overvoltage, minimum filters required to run bipole must not be switched out by Control.
- Bi-pole blocked TOVC due to Over Voltage at Kurukshetra**.**

Committee noted.

2H.5.	**Substation:**	**Multiple tripping's in Bina, Satna area**
	Date & time:	**24th and 25th January 2019.**

2H.5.1: Event Summary:

- Demand crash observed in Western and Eastern Region due to thunderstorm & heavy rain during intervening night of 24th-25th February 2019.
- Demand crash occurred in Eastern and Western Grid during intervening night of 24th-25th February 2019 due to heavy rain & thunder storm in mainly West Bengal, Odisha, Jharkhand, DVC, Chhattisgarh and Madhya Pradesh area.
- The Eastern region demand started reducing at around 21:00hrs of 24th Feb 2019 and was minimal 11050 MW at 04:45 hrs. (25.02.2019). The demand reduction resulted high voltage in the system.
- Trippings observed are as follows:

The details of transmission lines tripped during 24th-25th February 2019 is given below: Western Region				
S.No.	Element Name	Outage Date &Time	Restoration Date &Time	Reason
1	765kV Bilaspur - Sipat -2	24-Feb-19 & 22:06	25-Feb-19 & 01:38	Phase to ground fault
2	400 kV MCCPL-Bilaspur	24-Feb-19 & 22:14	25-Feb-19 & 00:15	Phase to ground fault
3	400 kV ACBIL-Bilaaspur	24-Feb-19 & 22:14	24-Feb-19 & 22:53	Phase to phase fault
4	400kV Korba West Ext-Bhillai	24-Feb-19 & 22:11	24-Feb-19 & 23:00	Phase to ground fault
5	400kV Korba - Birsinghpur-1	24-Feb-19 & 22:47	25-Feb-19 & 01:28	Phase to ground fault
6	400kV Bilaspur - Lanco -1	24-Feb-19 & 22:08	24-Feb-19 & 23:42	Phase to ground fault
7	400kV Korba - Raipur -3	24-Feb-19 & 22:42	25-Feb-19 & 02:24	Phase to ground fault
8	400kV Raigarh (Kotra) Bus 2A & 2B	24-Feb-19 & 22:48	Still Out	Phase to ground fault

The SLD/Report is enclosed at ***Annexure 2H.5***

2H.5.2: Discussion in 136th PCM:

Due to paucity of time this item was not discussed in the meeting and will be discussed in the next PCM meeting.

2H.6.	**Substation:**	**765/400 kV Dharamjaygarh s/s**
	Date & time:	**09.03.2019 at 16:10 hrs.**
	Event Category:	GI-2

2H.6.1: Event Summary:

- At 765/400 kV Dharamjaygarh s/s, 765 kV Dharamjaygarh-Jharsuguda-4 tripped due to blasting of main bay B phase CT.
- 765 kV Dharamjaigarh-Jhasarguda 1 also tripped during the event and it was a mal-operation.
- Trippings observed are as follows:
  1. 765 kV Dharamjaygarh-Jharsughuda 1
  2. 765 kV Dharamjaygarh-Jharsughuda 4
- PGCIL may give details in the PCM.

The SLD/Report is enclosed at ***Annexure 2H.6.***

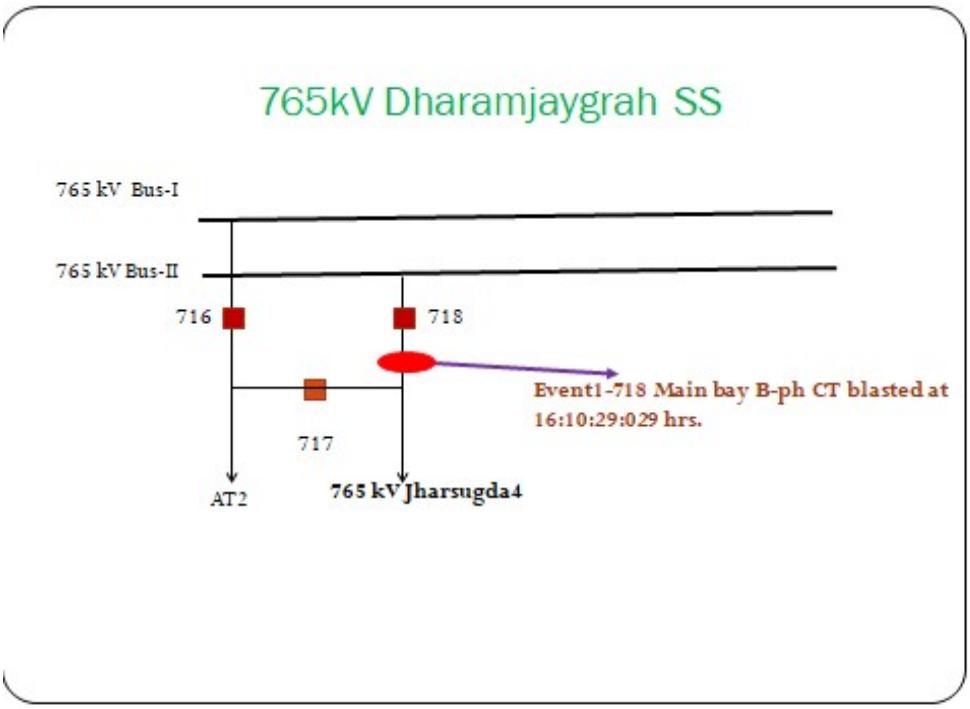
2H.6.2: Discussion in 136th PCM:

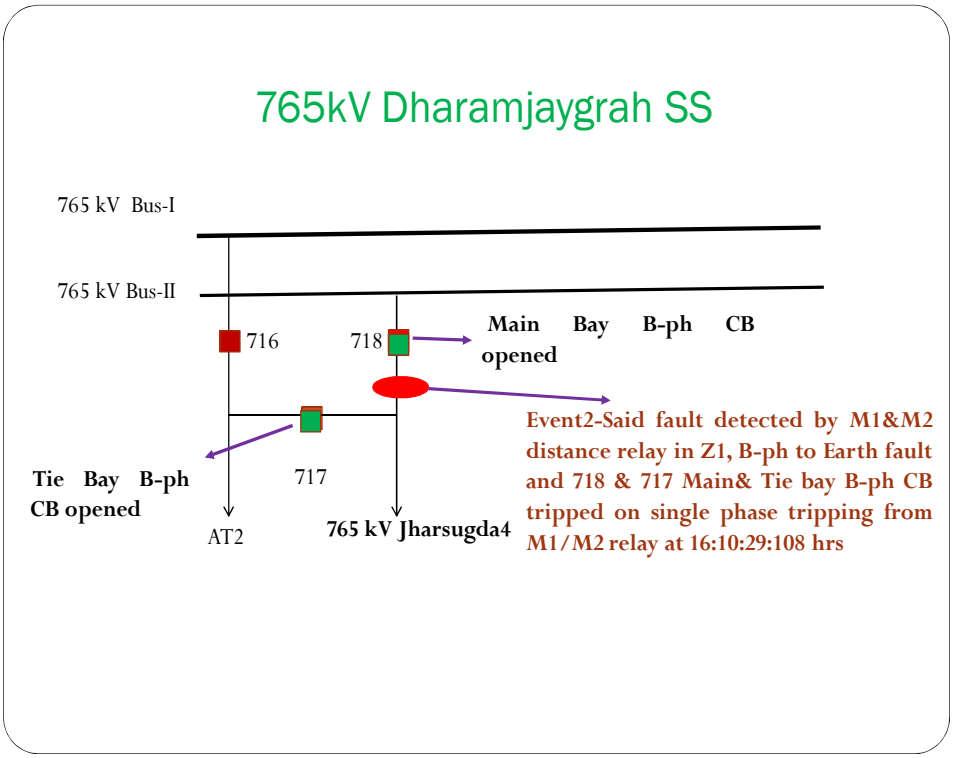
PGCIL representative informed the following;

- 765 kV Dharamjaygrah-Jharsugda 4 line 718 main bay B-ph CT was replaced on 7.03.2018 due to oil leakage. After completion of all pre commissioning tests, main bay along with CT taken in service on 8.03.2019, 16:11 hrs.
- On 09.03.2019 at 16:10;29 hrs. , the replaced CT i.e Jharsuguda 4 Main Bay B Phase CT blasted with huge explosion and fire which resulted into tripping of following elements at Dharamjaygrah SS .

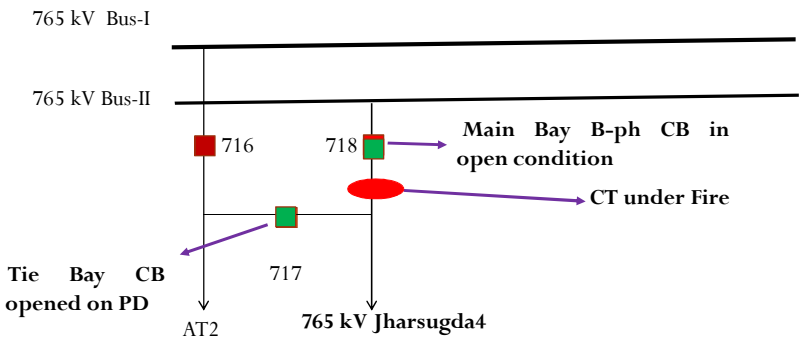
  A. 765 kV Bus-2 tripped on LBB protection.
  B. 765 kV Jharsugda4 line Tripped on Z1 distance protection operation.

SLD of the event1to event 5 is as follows:-



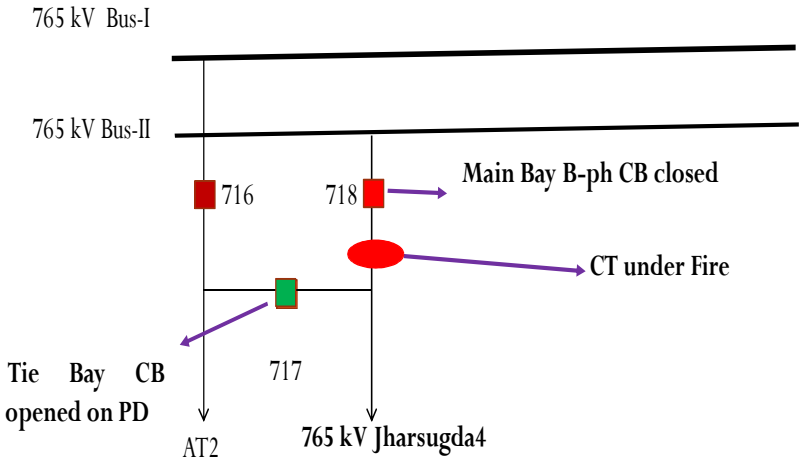


765kV Dharamjaygrah SS

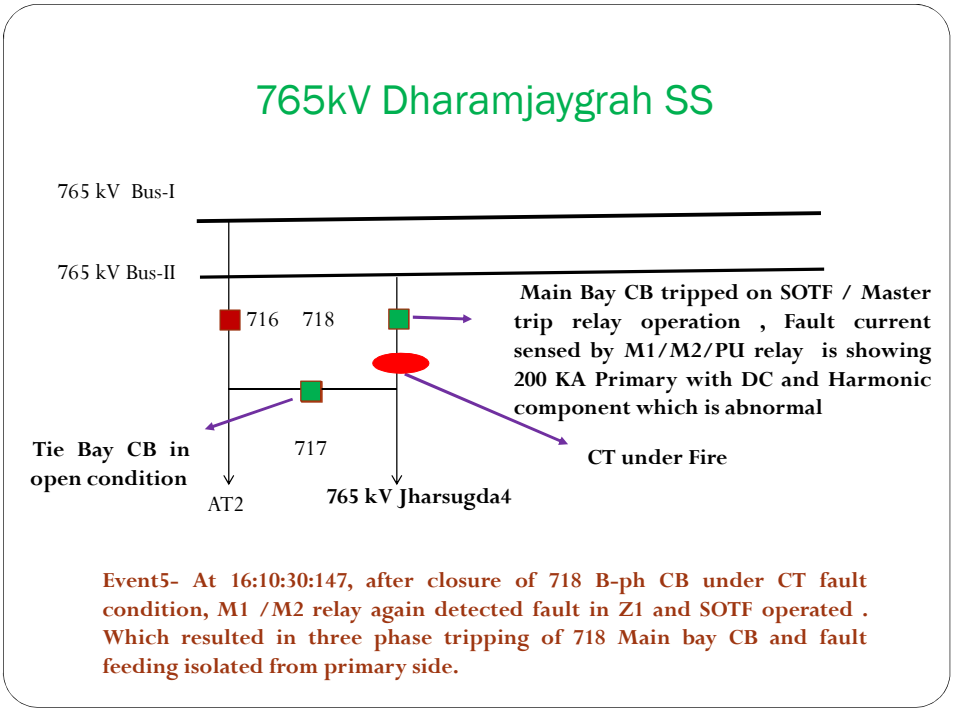


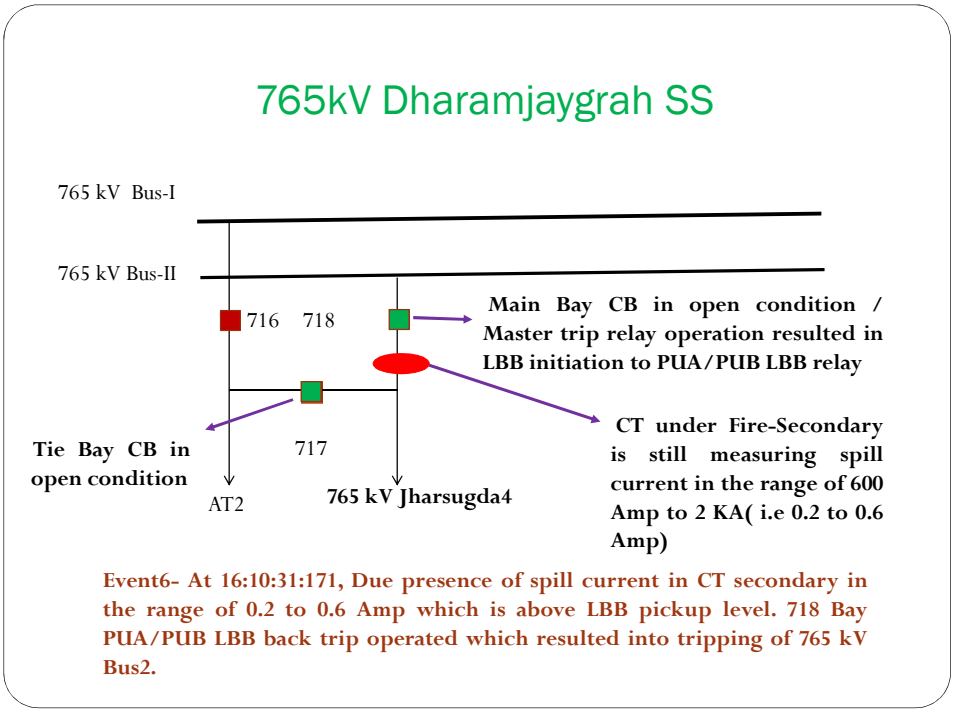
Event3- 717 Tie CB tripped on PD , As ICT bay on Bus1 side , Hence PD timer kept as 500 ms

765kV Dharamjaygrah SS

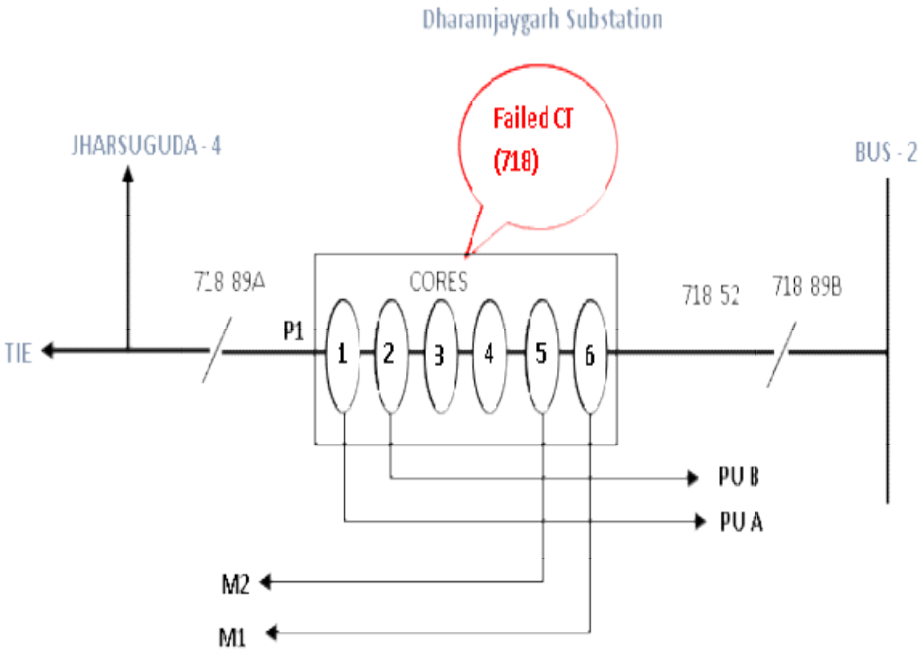


Event4- At 16:10:30:142, 718 Main CB AR operated , 718 Main bay CB closed on successful Auto reclose





- On sudden inception of fault within the CT, the CT blasted. This fault seen by both the Main 1/ 2 relays in Zone 1 and not sensed by Bus Bar differential protection. This might be the indication of failure of CT near by P1 terminal as core 5/6 used for M2/M1 and core 1 /2 are used for PUA / PUB as shown in the below figure.



- On Reclosing attempt of 718 Main bay CB, secondary fault current sensed by M1,M2 and PU relay is in the range of 60 to 80 AMP
- Bus Bar tripped due to LBB.

Committee observed the following:

- Committee observed that the newly replaced main bay CT of 765 kV Jhasurguda 4 blasted, followed by the tripping of the 765 kV Jhasurguda 4 line on Zone 1 protection operation.
- During the A/R of the line, 765 kV Jhasurguda 1 was seeing the reverse zone fault in zone 1, attempted A/R and tripped. The tripping of Jhasurguda 1 on Zone 1 DPR for the fault in reverse zone was mal operation.
- PGCIL representative informed that, the problem was taken up with OEM.
- The Jhasurguda 4 tripped on Zone 1 and it may be due to fault happened next to the CT core used for Main 1&2 distance protection of line 4.
- 765 kV Dharamjaygarh Bus 2 tripped on LBB extension from Jhasurguda 4 Main bay due to the continuous spill current seen in Peripheral Unit A and Peripheral Unit B.
- Committee also observed that from the Jhasurguda 4 DR, the main bay tripped due to the BB protection operation and it was reclosed on 3 phases during A/R attempt and then the three phases tripped. The tie bay was not attempting A/R and tripped on pole discrepancy.
- Committee requested PGCIL to submit the analysis report to PCM at the earliest.

2H.7.	Substation:	765/400 kV Bhuj s/s
	Date & time:	18.03.2019 at 21:09 hrs.
	Event Category:	GI-2

2H.7.1: Event Summary:

- At Bhuj S/s, R phase CT of 400 kV, 125 MVAR BR main bay failed and resulted in tripping of all the elements connected to 400 kV Bus 2, on Bus bar protection operation.
- 400 kV Bhuj Bus 1 was under planned outage during the event.
- Tripping's observed are as follows:
  1. 400 kV 125 MVAR Bhuj Bus reactor
  2. 765/400 1500 MVA Bhuj ICT 1
  3. 765/400 1500 MVA Bhuj ICT 2
- PGCIL may give details in the PCM.

The SLD/Report is enclosed at ***Annexure 2H.7.***

2H.7.2: Discussion in 136th PCM:

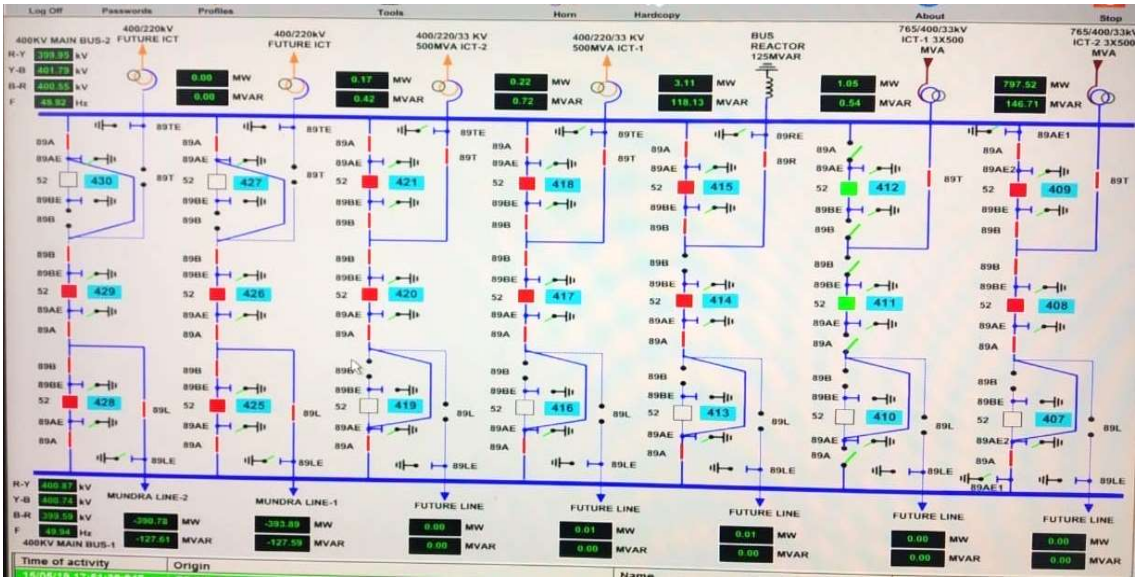
PGCIL representative informed the following;

- Following elements were in service through respective Main / Tie Bay as detailed below: -
  1. 400kV BR – Charged through both Main & Tie Bay
  2. 400kV ICT#2 - charged through Main Bay only
  3. 765kV ICT#1 – on 400kV side charged through Main Bay only

During the event tripping indications are as follows: -

- At 21:09hrs, R Ph CT of Main Bay of 400kV Bus Reactor got blasted. This has resulted in tripping of 400kV Bus#2 (Busbar differential protection optd) and 400kV Bus Reactor tripped on Differential protection.
- Apart from above, as 400kV ICT#2 and 765kV ICT#1 were charged through Main Bay only, the same also got tripped as 400kV Bus#2 got tripped.

SLD of 765/400 kV Bhuj s/s is given below:



Committee observed the following:

- Committee observed that the R Ph CT of Main Bay of 400kV Bus Reactor got blasted which resulted in tripping of 400kV Bus#2 (Busbar differential protection operation) and 400kV Bus Reactor tripped on Differential protection. Protection operations of theses tripping were found in order.
- However, committee observed that 765kV ICT#1 didn't trip from 765kV side. It was found out that DC loop for this inter-trip scheme (in case of Busbar operation) was found loose. Committee opined that proper maintenance of equipment may help in avoiding such type of incidents in future.
- PGCIL representative informed that matter has been taken up with OEM for failure of CT.

Committee requested PGCIL representative to submit the CT failure analysis report to the PCM at the earliest. Committee also suggested that failure of CT in a newly commissioned substation was undesirable and PGCIL need to check the same batch of CT installed in Bhuj substation.

2H.8.	**Substation:**	**800 kV HVDC Champa-Kurukshetra terminal**
	Date & time:	**20.03.2019 at 12:43 hrs.**
	Event Category:	GI-2

2H.8.1: Event Summary:

- ± 800 kV HVDC Champa-Kurukshetra Bi-Pole blocked on filter power limit on Champa end during ramping down process.
- Trippings observed are as follows:
  1. 800 kV HVDC Champa-Kurukshetra Pole 1
  2. 800 kV HVDC Champa-Kurukshetra Pole 2
- PGCIL may give details in the PCM.

The SLD/Report is enclosed at ***Annexure 2H.8.***

2H.8.2: Discussion in 136th PCM:

PGCIL representative informed the following;

- Blocked during ramping down process due to filter power limit at Champa.
- Initial Conditions: Bi-pole @300MW each pole 150MW.
- This Incident occurred during Pole 3 testing as per part of Pole 3 on load testing activities as per approved OCC from 18.03.2019 to 28.03.2019.

Committee observed the following:

- Committee observed that on 20th March 2019 at 12:43 Hrs, 800 kV HVDC Champa-Kurukshetra tripped Bi-pole on Filter control block due to filter power limit at Champa end. The incident occurred during the testing of Champa HVDC Pole 3. Prior to the event both the poles carry 150 MW each.

Committee suggested that following the Standard operating procedure during the testing and commissioning of Champa HVDC Pole 3 and 4 may help in avoiding such type of occurrences in future and requested PGCIL to follow the Standard operating procedure during the testing and commissioning of Champa HVDC Pole 3 and 4.

2H.9.	**Substation:**	**765/400 kV Bhuj s/s**
	Date & time:	**21.03.2019 at 19:53 hrs.**
	Event Category:	GD-1

2H.9.1: Event Summary:

- At Bhuj S/s, Y phase LA of 765 kV 330 MVAR B/R failed and created Y phase fault. The B/R tripped on differential protection operation.
- 765 kV Banaskantha-Bhuj 1&2 tripped from Banaskantha end only, on Zone 2 distance protection operation due to instantaneous time setting in Main 2 relay.
- 400 kV Bhuj-CGPL 2 tripped at Bhuj end on DT received from CGPL end due to O/V stage 2 operation at CGPL end.
- 400 kV Bhuj Bus 1 was under planned outage during the event.
- Tripping's observed are as follows:
  1. 765 kV 330 MVAR Bhuj Bus reactor
  2. 765 kV Bhuj-Banaskantha 1
  3. 765 kV Bhuj-Banaskantha 2
  4. 400 kV Bhuj-CGPL 2
  5. 765/400 1500 MVA Bhuj ICT 1
  6. 765/400 1500 MVA Bhuj ICT 2
- PGCIL may give details in the PCM.

The SLD/Report is enclosed at ***Annexure 2H.9.***

2H.9.2: Discussion in 136th PCM:

PGCIL representative informed the following;

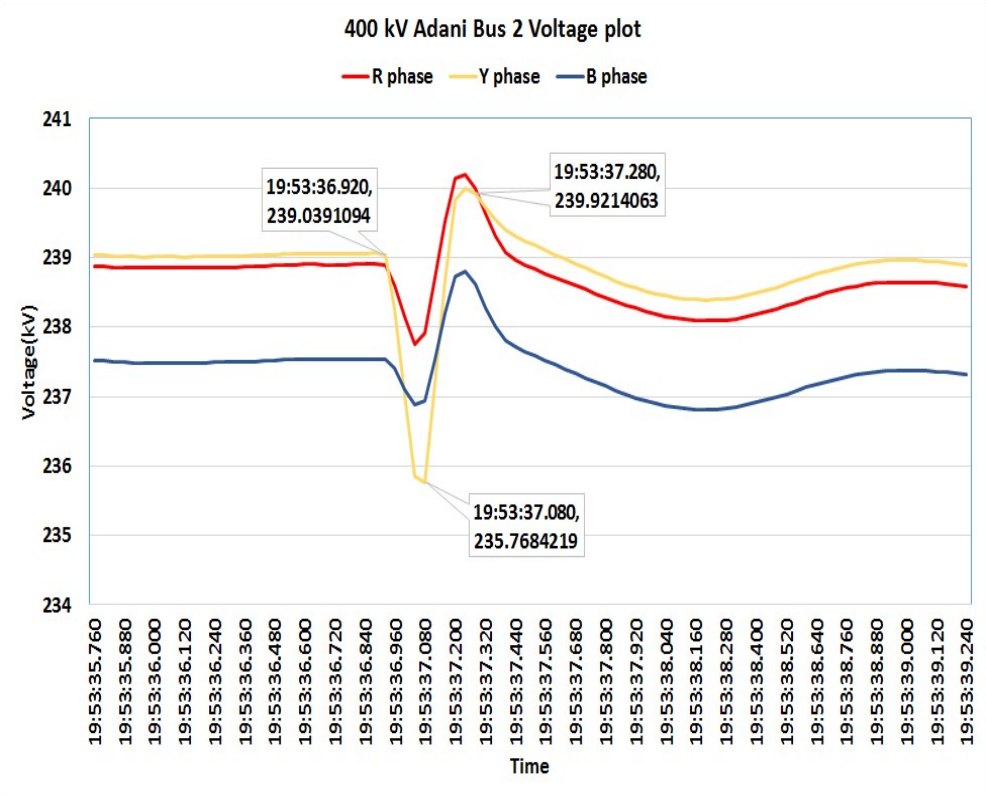
- At 765/400/220kV Bhuj S/s, following elements were in service: -
  1. 400kV Mundra Bhuj#2
  2. 765kV Bus Reactor
  3. 765/400kV ICT#1&2
  4. 765kV Bhuj Banaskantha#1&2

- On 21/03/19 at 19:53:36 hrs, Y Ph Lightening Arrestor of 765kV Bus Reactor at Bhuj S/s failed (conducted) which resulted in tripping of Bus Reactor on Differential protection.

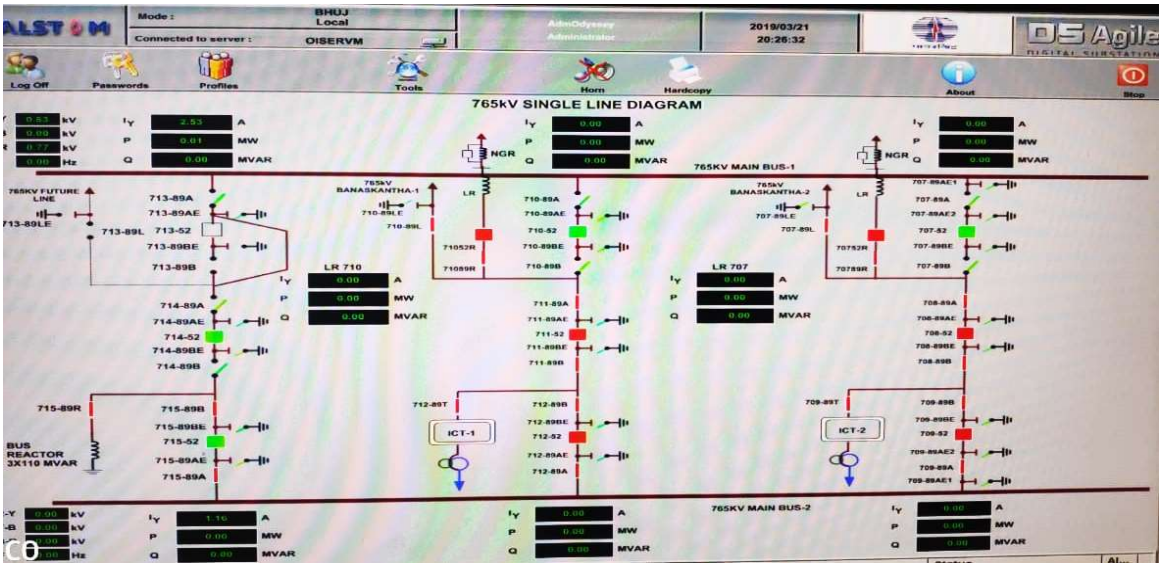
Following are the elements tripped during the incident: -

Name of Element	Time of Tripping	Tripping Indication	Remarks
765kV Bus Reactor	19:53:36.877	Y Ph Differential Optd.	Y Ph Lightening Arrestor of 765kV Bus Reactor got failed (conducted) which resulted in tripping of Bus Reactor on Differential protection
400kV Mundra Bhuj#2	19:53:37.170	Direct trip Receive	First at 19:53:36.925 hrs, permissive Carrier is received at Bhuj end and as per DR, Y Ph got opened at CGPL end. It was found that Zone 1 optd at CGPL - Mundra end (as CGPL has kept Zone 1 reach as 100%). Afterwards, line tripped on DT receive due to over voltage stage#2 at Mundra end.
765kV Bhuj Banaskantha# 1&2	19:53:36.926	Zone 2 optd at Banaskantha end	It was observed that at Banaskantha end, in Main 2 relay, the Zone 2 time delay was not set (kept instantaneous during anti-theft charging of line, the same got left out inadvertently for normalization after loading of lines). The same has been restored

400 kV Adani Bus 2 Voltage plot during the event is given below:-



SLD of the 765/400/220kV Bhuj S/s is given below:-



Committee observed the following:

- Committee observed that Y phase LA of 765 kV 330 MVAR Bhuj B/R failed and created Y phase fault and B/R tripped on differential protection operation at 19:53:36.938 Hrs.
- PGCIL representative informed that 765 kV Banaskantha-Bhuj 1&2 tripped from Banaskantha end only, on Zone 2 distance protection operation at 19:53:36.974 and 19:53:36.967 Hrs respectively and also informed that the time setting in Main 2 relay was inadvertently kept instantaneous for Zone 2, the settings which was adopted during anti-theft charging and was not changed.
- Committee observed that the 400 kV Bhuj-CGPL 2 tripped at Bhuj end on DT received from CGPL end due to O/V stage2 operation at CGPL end. From CGPL end fault was seen by the Distance relay in Zone 1 Extension and carrier was sent to Bhuj end and Bhuj end relay was seeing the fault in reverse Zone. During Y Phase A/R dead time from CGPL end, the Y phase Voltage at CGPL end crossed Stage 2 O/V setting and the line tripped at 19:53:37.183 Hrs. Since all the connected incoming lines tripped, Bhuj station went blackout.
- Committee also observed that the tripping of 765 kV Banaskantha- Bhuj D/C was undesirable and distance relay Zone 2 time settings at Banaskantha end need to be changed.
- Committee also suggested that in future care to be taken to set the timings as per protection criteria and to be confirmed before first time charging and also suggested that failure of LA in a newly commissioned substation was undesirable and PGCIL need to check the same batch of LA installed in Bhuj substation.

Committee requested PGCIL to furnish the detailed analysis report of the failure of LA at the earliest to PCM.

2H.10.	**Substation:**	**800 kV HVDC Champa-Kurukshetra terminal**
	Date & time:	**23.03.2019 at 12:54 hrs.**
	Event Category:	GI-2

2H.10.1: Event Summary:

- ± 800 kV HVDC Champa-Kurukshetra Bi-Pole blocked on Common Neutral Area Protection (CNAP) operaton
- Trippings observed are as follows:
  1. 800 kV HVDC Champa-Kurukshetra Pole 1
  2. 800 kV HVDC Champa-Kurukshetra Pole 2
- PGCIL may give details in the PCM.

The SLD/Report is enclosed at ***Annexure 2H.10.***

2H.10.2: Discussion in 136th PCM:

PGCIL representative informed the following;

- Initial Conditions: Bi-pole @300MW each pole 150MW.
- The reason for the fault was due to Common neutral area signal exchange issue between Pole-1 & Pole-3 during new software testing.
- This Incident occurred during Pole 3 testing as per part of Pole 3 on load testing activities as per approved OCC from 18.03.2019 to 28.03.2019.

- On 23rd March 2019 at 12:53 Hrs, 800 kV HVDC Champa-Kurukshetra Bi-pole tripped on Common Neutral Area Protection (CNAP) operation at Champa end. As reported by Champa HVDC, this tripping was a maloperation due to the new parallel operation software. Prior to the event both the poles carry 150 MW each.

Committee noted as above.

2H.11.	**Substation:**	**800 kV HVDC Champa-Kurukshetra terminal**
	Date & time:	**30.03.2019 at 16:33 hrs.**
	Event Category:	GI-2

2H.11.1: Event Summary:

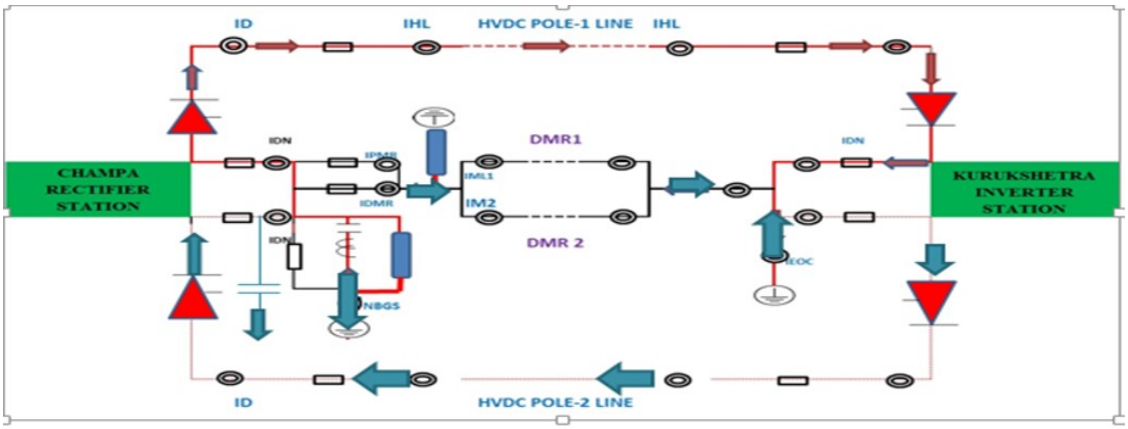
- ± 800 kV HVDC Champa-Kurukshetra Bi-Pole blocked on Earth over current protection operation at Kurukshetra end.
- Trippings observed are as follows:
  1. 800 kV HVDC Champa-Kurukshetra Pole 1
  2. 800 kV HVDC Champa-Kurukshetra Pole 2
- PGCIL may give details in the PCM.

The SLD/Report is enclosed at ***Annexure 2H.11.***

2H.11.2: Discussion in 136th PCM:

PGCIL representative informed the following;

- 2H.11:Bi-pole Blocked due to NBGS close at Champa and NBGS over current protection operated at Champa due to mal-operation of analog isolation card 5008.
- Initial Conditions: Bi-pole @450MW each pole 225MW.



- NBGS breaker having a series DCCT. The DCCT current measured an abrupt value due to Damaged 5008 card ,which leading to controls issued Reclose command.(The breaker open condition and current showing some arbitrary value condition)
- NBGS closed at champa due to reclose command.

Report & Remedial measures Taken to avoid Tripping are as follows:-

- Damaged 5008 Cards were changed subsequent to the incident.

On 30th March 2019 at 12:53 Hrs, 800 kV HVDC Champa-Kurukshetra Bi-pole tripped on Over current Earth fault protection operation at Kurukshetra end. Prior to the event both the poles carry 225 MW each.

Committee noted as above.

2H.12.	**Substation:**	**765/400 kV Gwalior s/s**
	Date & time:	**30.03.2019 at 10:34 hrs.**
	Event Category:	GI-2

2H.12.1: Event Summary:

- 765 kV Gwalior Bus 2 tripped on Bus bar protection operation due to the foreign material which came near the Induction zone.
- All the elements connected via tie bay to 765 kV Bus 1.
- Tripping's observed are as follows:
  1. 765 kV Gwalior Bus 2
- PGCIL may give details in the PCM.

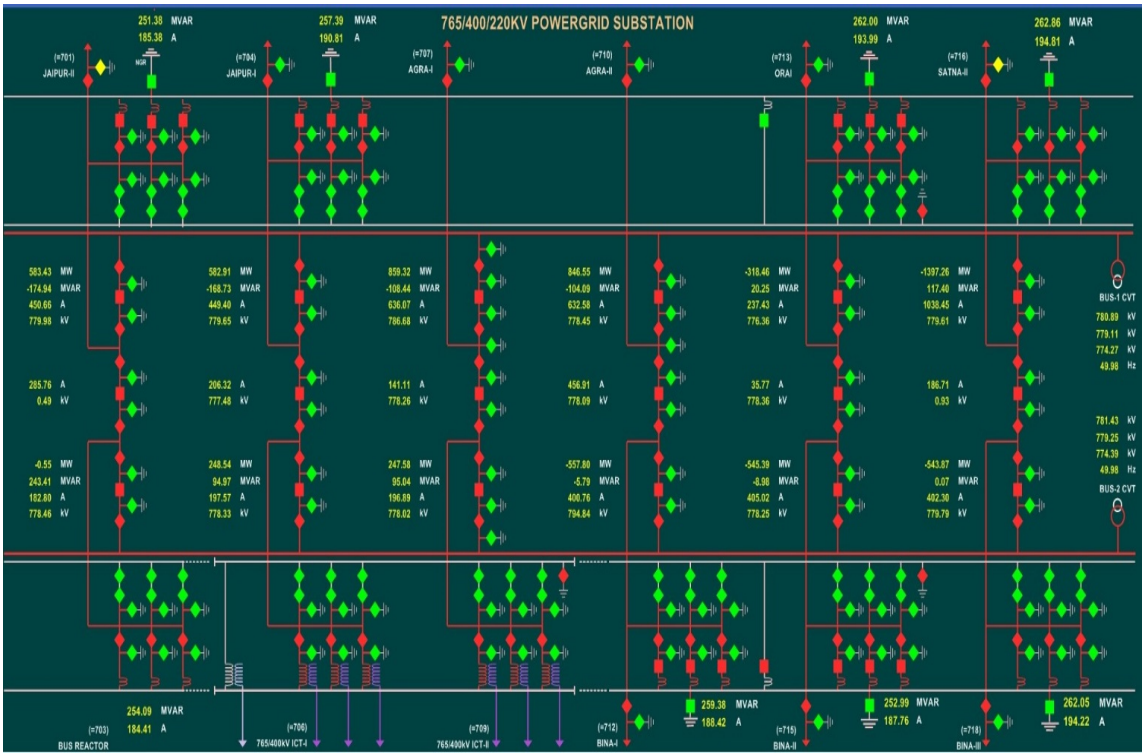
The SLD/Report is enclosed at ***Annexure 2H.12.***

2H.12.2: Discussion in 136th PCM:

PGCIL representative informed the following;

- At 765/400/220kV Gwalior S/s, all the elements were in service except 765kV Bina Gwalior#3 which was under shutdown for AMP works.
- On 30/03/19 at 10:33 hrs, 765kV Bus#2 got tripped due to R ph to Earth fault. Bus bar differential protection operated for in zone fault. This resulted in opening of all the main bays connected on 765kV Bus#2.
- There was no element tripping.
- During visual inspection of the yard, no abnormality could be found out. However, on detailed inspection, burnt foreign material (plastic rope) found on the gravels.

SLD of 765/400/220kV Gwalior S/s is given below:



Committee observed the following:

- PGCIL representative informed that construction activities were going on nearby the bus bar area and also informed that during visual inspection of the yard, no abnormality could be found out. However, on detailed inspection, burnt foreign material (plastic rope) found on the gravels.

- MS,WRPC opined that the construction work left over plastic material might have caused this fault and requested to remove all the left over construction material specifically plastic covers and threads from the charged zone.

Committee suggested that immediate removal of the left over construction material after completion of the construction activities may help in avoiding similar type of incidents in future.

2I.Occurrences in NTPC systems:

Nil

2J. Occurrences in IPP system:

2J.1.	**Substation:**	**765/400 kV Bhopal substation (BDTCL)**
	Date & time:	**14.02.2019 at 01:58 hrs.**
	Event Category:	GI-2

Event Summary:

- At 765/400 kV Bhopal substation,765 kV Bhopal-Indore tripped at Indore end on B phase to earth fault but from the Bhopal end line was not tripped on distance protection due to the problem in B phase CVT.
- Since the DEF setting was 1.5 second, 765 kV Bhopal-Jabalpur tripped from Jabalpur end on Zone 3 distance protection operation and the line tripped at Bhopal end due to the DT receipt from Jabalpur on Overvoltage.
- 765 kV Bus reactor tripped on differential protection operation.
- Trippings observed are as follows:
  1. 765 kV Bhopal-Indore
  2. 765 kV Bhopal-Jabalpur
  3. 765 kV Bhopal Bus reactor

The SLD/Event Report is enclosed at ***Annexure 2J.1.***

2J.1.2) Discussion in 136thPCM:

Committee observed that BDTCL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2J.2.	**Substation:**	**Tripping of Units at ACBIL, MCCPL**
	Date & time:	**24.02.2019 at 22.14 hrs.**
	Event Category:	GD-1

2J.2.1) Event Summary:

- Due to the tripping of 400 kV Bilaspur-ACBIL and 400 kV Bilaspur-MCCPL on B-E fault, ACBIL and MCCPL generators tripped due to the loss of evacuation path and got blacked out.
- Trippings observed are as follows:

1. 400 kV ACBIL-BILASPUR 1
2. 400 kV MCCPL-Bilaspur1
3. 300 MW MCCPL Unit 1
4. 30 MW Chakabura Unit 1
5. 30 MW Chakabura Unit 2
6. 135 MW ACBIL Unit 2
7. 50 MW SCPL Unit 2

The SLD/Event Report is enclosed at ***Annexure 2J.2.***

2J.2.2) Discussion in 136thPCM:

Committee observed that ACBIL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2J.3.	**Substation:**	**400 kV JP Bina substation**
	Date & time:	**18.03.2019 at 22:01 hrs.**
	Event Category:	GD-1

2J.3.1) Event Summary:

- At JP Bina S/s, R phase CT of Station Transformer blasted and caused tripping of all the elements connected to 400 KV Bus 1&2 on Bus bar protection operation.
- Trippings observed are as follows:

1.400 kV JP Bina-Bina (PG)
2.400 kV JP Bina-Bina (MP)
3.250 MW JP Bina Unit 1
4.250 MW JP Bina Unit 2

The SLD/Event Report is enclosed at ***Annexure 2J.3.***

2J.3.2) Discussion in 136thPCM:

Committee observed that JP Bina representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2J.4.	**Substation:**	**Tripping of Units at ACBIL,MCCPL, ACBIL Chakabura and SCPL**
	Date & time:	**03.06.2018 at 16.26 hrs.**
	Event Category:	GD-1

2J.4.1) Event Summary:

- Loss of evacuation lines due to earth faults led to the tripping of Units at ACBIL,MCCPL, ACBIL Chakabura and SCPL.
- Trippings observed are as follows:
  - 400 kV MCCPL- Bilaspur
  - 400 kV ACBIL - Bilaspur
  - 400 kV MCCPL- ACBIL
  - Unit 1&2 ACBIL (135*2 MW)
  - Unit 1&2 ACBIL Chakabura (30*2 MW)
  - Unit 1&2 SCPL (50*2 MW)
  - Unit 1 MCCPL (300 MW)

The SLD/Event Report is enclosed at ***Annexure 2J.4.***

2J.4.2) Discussion in 136thPCM:

Committee observed that ACBIL representative was not present in the meeting and therefore the disturbance could not be explained to the sub-committee. The same shall be taken up in the next PCM.

2K. Follow up of compliance of 128th PCM to 135th PCM recommendations

2K.1) The compliance status of the 128th to 135th PCM recommendations was placed before the committee**.**

Utilities were requested to furnish the compliances in the PCM.

2K.2) Discussion in 134rd PCM:

Committee discussed the compliances of the pending recommendations of past PCMs and the updated status is enclosed at **Annexure 2K.1**

2K.3) Discussion in 135th PCM:

Committee observed the status of compliances of the recommendations of past PCMs are yet to be submitted by constituents and all the Utilities were requested to furnish the compliances at the earliest to PCM.

2K.4) Discussion in 136th PCM:

Committee observed the status of compliances of the recommendations of 129-134 PCM has been by many of the constituents and all the Utilities were requested to furnish the compliances of 135th PCM at the earliest to PCM. Updated status of the compliances of the recommendations of past PCMs is enclosed at **Annexure 2K.1**

ITEM NO. 3: Tripping of lines / ICTs :

The minor incidences of tripping of lines and ICTs during the period 01-01-2019 to 30-04-2019 to be discussed is enclosed at **Annexure–3.**

Committee noted.

ITEM NO. 4: State Level Relay Co-ordination Groups:

Back ground: In the 128th& 129th PCM the issue of formation of "State level Relay Co-ordination Group" (SRCG) was discussed in detail to review the relay settings within the State, so that the settings are co-ordinated. It was decided that SLDC shall be the convener of the group and the SRCG of the States shall periodically review the relay coordination in their State. The proposals for revision of relay settings then shall be put up to the PCM forum for ratification.

131st& 132nd PCM discussion:

Following critical areas were identified for relay protection co-ordination in the 131st PCM;

Maharashtra	Akola, Talegoan, APL Tirora and Mumbai-MSETCL interconnections.
Gujarat	SSP, Kakrapar,Kawas&Gandhar.
MP	Omkareshwar&Damoh.
Chattisgarh	Korba (W) &Bhilai.

132nd PCM updates:

In the 132nd PCM, WRPC informed that in order to expedite the matter, a letter conveying the decision regarding identified critical networks in the States was sent to all SLDCs from WRPC Secretariat.

Gujarat representative informed that the 1st meeting of the relay co-ordination group for the systems of Akrimota and Panandroh S/s were taken up in October 17 and issues observed were rectified. The 2nd meeting of the relay co-ordination group is planned in first half of May 2018.

MP representative stated that 1st meeting has been convened and the system of Omkareshwar was identified. Second meeting is scheduled to be held in May 2018.

Maharashtra SLDC representative stated that the State level group has been formed and the 1st meeting was proposed to be held in April 18. However due to reshuffling of engineers in MSETCL the same has been postponed and protection co-ordination of the interface lines with Mumbai system would be held shortly.

133rd PCM Discussions :

Maharashtra representative informed that the first meeting was held on 23rd April 2018 to review the relay coordination of Mumbai Interconnections between MSETCL & TATA. CSPTCL representative informed that the first meeting was held and the MoM would be shared shortly.

Committee stressed that regular meetings of the State level Relay Co-ordination groups be held for review of relay coordination of interconnections and the MoM be shared with PCM.

4A.5.) NPCIL informed that M/s MSETCL vide letter dated 05.05.2018 indicated that the proposed distance relay settings found correct.

- Proposed relay settings (at TAPS 1&2 end) for 220kV TAPS-Boisar& TAPS-Borivali feeders distance protection relays were sent to M/s MSETCLfor review.
- M/s MSETCL has indicated vide their email dt.05.05.2018 that, the proposed relay settings(at TAPS 1&2 end)for TAPS-Boisar& TAPS-Borivaliare checked & found correct.
- The gist of proposed changes in the settings is attached as **Annexure-4A.5**.
- The proposed settings (at TAPS 1&2 end) of TAPS-Boisar& TAPS-Borivali distance relays are enclosed herewith for your concurrence & approval please.

4A.6.) 134th PCM Discussions:

As far as Item 4A.5) above Committee suggested that the settings should be mutually agreed between NPCIL, MSETCL & GETCO and the same can be implemented by NPCIL on receiving communication of confirmation from MSETCL & GETCO.

4A.7.) 135th PCM Discussions:

Maharashtra representative informed that the second meeting on Relay Setting Coordination Group (RSCG) was held at SLDC,Airoli, Navi Mumbai on 13th August at 11.00 hrs. During the meeting protection setting coordination of 220 KV TAS & MSETCL lines were discussed. MoM of the meeting enclosed as annexure 4A.7 (A).

SLDC, Gujrat representative informed that 2nd level Protection committee was held on 08.05.2018, during the meeting CEA guidlines of Ramakrishna committee, inspection of AUFLS scheme, review of SPS were discusses. MoM of the meeting enclosed as annexure 4A.7 (B).

Committee stressed that regular meetings of the State level Relay Co-ordination groups be held for review of relay co ordination of interconnections and the MoM to be shared with PCM.

As far as Item 4A.5) above Committee suggested that the settings should be mutually agreed between NPCIL, MSETCL & GETCO and the same can be implemented by NPCIL on receiving communication of confirmation from MSETCL & GETCO.

4A.8.) 136th PCM Discussions:

NPCIL representative informed that the implementation of revised distance relay settings of 220kV TAPS-Borivali feeder at TAPS end has been done on 26.04.2019. The revised implemented settings as furnished by NPCIL are enclosed as annexure 4A.7 (C).

MSLDC representative informed that based on the action taken report of the first and second meeting, they are proposed to conduct the third meeting most probably in the month of June 2019.
GETCO representative informed that most of the relay setting coordination issues were addressed during the first and second meetings and also informed that the third meeting will be held in the month of June 2019 or July 2019.

MS,WRPC stressed that regular meetings of the State level Relay Co-ordination groups be held for review of relay coordination of interconnections and the MoM to be shared with PCM.

ITEM NO. 5: Hon'ble CERCs orders on the Grid disturbance of 30.07.2012 & 31.07.2012

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

5.1.1) Back ground:
CERC vide its order dated 21.02.2014 in respect to petition No. 220/MP/2012 filed by POWERGRID have directed that CTU and SLDCs shall submit quarterly Protection Audit Report to the respective RPC latest by15thday of the first month of next quarter and RPCs shall submit the report to the Commission latest by15thday of the second month of next quarter. The Member Secretary of Regional Power Committees shall monitor the protection related issues and bring to the notice of the Commission any instance of non-compliance of the Regulation1.5of the Grid Code in respect of the protection related issues considered in the instant petition.

5.1.2) 128th& 129th PCM discussion:
New substations have been integrated to the grid at 400 and 765 kV level like Kala, Daman, Vadodara, Nanded, Chandrapur2, Koradi3, Koradi2, Pune, Pune GIS, Kolhapur GIS, Durg, RaigarhTamnar, Kotra, Dharamjaigad, Jabalpur PS, Vindhyachal PS, Vindhyachal stage 4 and 5, Indore PG, Marwa, Raita, Astha, Sujalpur PG. Therefore, utilities may kindly propose the dates for the third party protection audit as per the format given in the Ramakrishna Committee report.

GETCO, PGCIL & NTPC intimated that all the protection audit observations for protection audit carried out in phase-1 have been complied. Further Maharashtra, Chattisgarh and MP intimated that protection audit

observations for protection audit carried out in phase-1, not involving procurements have been complied

5.1.3) 131st PCM discussion:

It was informed that the compliances received from the states for the third quarter (October to December 2017) have been sent to CERC, the same is available on WRPC web site www.wrpc.gov.in-->meetings-->Protection-->Minutes-->PAR_Dec_2017_latest.

Maharashtra representative stated that they are taking up the protection audit in a phased manner and they have already identified the S/Ss to be taken up for protection audit. Further the compliances are mainly pending for protection audits carried out in the recent past.

Gujarat & MP representatives stated that they have also taken up identification of the S/Ss for protection audit and the same shall be intimated to PCM as soon as it is done.

5.1.4) 132nd PCM discussion:

The forum requested Gujarat to provide the breakup of 114 nos of Substations where first phase Protection Audit completed the before 2012. The forum also requested PGCIL to submit the status in above format.

Member Secretary, WRPC expressed that the progress on above subject matter is slow. This issue of Protection Audit was also discussed in Grid Study Committee meetings. Since Protection audit activity is a cyclical activity so after every five years protection audit of all the critical S/Ss above 220kV level has to be carried out. Therefore it is utmost necessary to comply with all the Protection Audit observations of the first phase and take up second phase of Protection Audit.

Committee requested all the utilities to get all the Category B protection audit observations attended, take up protection audit of newly commissioned S/Ss and S/Ss where protection audit has been carried out 5 years back.

PGCIL may submit the status in the above format. GETCO may provide the break up details of 114 no's of Substations where first phase Protection Audit completed the before 2012. A letter has been written from WRPC secretariat to all the constituents asking the update and status and action plan for 2nd phase of protection audit. Constituents/STUs may update the status.

The data has not been received yet Utilities are requested to furnish the data of Protection Audit already carried out and the tentative plan of Protection audit of new and existing S/Ss in their system.

5.1.5) 133rd PCM discussion:

The status regarding the taking up the protection audit of second phase was discussed and the update on the same is as follows;

PGCIL, GETCO & MPPTCL representatives informed they have already planned the activity to be done through independent agency. MSETCL

representative informed that they are planning to carry out the protection audit through independent agency. NSPCL representative informed that they have already carried out PA of their S/S. NTPC & CSPTCL representative informed that they will inform the status shortly.

5.1.6) 134th PCM discussion:

It was informed that the compliances received from the states for the second quarter (July to September 2018) have been sent to CERC, the same was available on WRPC web site **http://www.wrpc.gov.in/pcm/PAR_September_2018.pdf.**

5.1.7) 135th PCM Discussions:

CERC vide its order dated 21.02.2014 in respect to petition No. 220/MP/2012 filed by POWERGRID have directed that CTU and SLDC s shall submit quarterly Protection Audit Report to the respective RPC latest by15th day of the first month of next quarter and RPC s shall submit the report to the Commission latest by15thday of the second month of next quarter.

5.1.8) 136th PCM Discussions:

Protection Audit Report for the fourth quarter of 2018-19 (January 19 to March 2019) has not yet received from CTU and SLDCs excluding SLDC, Gujarat and SLDC, MP and PGCIL.

SLDCs and CTU/WRLDC are requested to submit the data at the end of every quarter to WRPC, in compliance to the above CERC order dated 21.02.2014, so that the quarterly data submission can be made by WRPC to CERC.

The updated status (in 136th PCM) of the protection audit observations is as given below

Year	State /utility	No of S/s Audited	Obseravations in Category A (Procurement not required)			Obseravations in Category B (Procurement required)			Status FC/PC/ NC	Remarks if any
			No of Deficiencies Observed	No of Deficiencies rectified	No of Deficiencies pending	No of Deficiencies Observed	No of Deficiencies rectified	No of Deficiencies pending		
2012-13	Gujarat	S/s Audited before 2012 - 121	3781	3781	**0**	**NA**			**FC**	Protection Audit completed before 2012 and all are complied
		S/s Audited before 2012 - 13 are - 121	1191	1191	0	NA			FC	Protection Audit completed before 2012 and all are complied
	MP	12	80	79	1	76	38	38	PC	
	Maharashtra	122	114	114	0	53	53	0	FC	FC
	Chhattisgarh	13	15	15	0	61	61	0	FC	
	PGCIL (WR-I)	11	9	9	0	0	0	0	FC	FC
	NTPC	4	8	8	0	5	5	0	FC	
2013-14	Gujarat	11	611	611	0	NA			FC	
	MP	25	83	83	0	42	14	28	PC	
	Maharashtra	154	147	147	0	92	92	0	FC	
	Chhattisgarh	5	18	12	6	21	6	15	PC	
	PGCIL	NA	NA	NA	NA	NA	NA	NA	FC	FC
2014-15	Gujarat	NA	NA	NA	NA	NA	NA	NA	FC	FC
	MP	18	94	89	5	55	30	25	PC	
	Maharashtra	107	210	210	0	93	93	0	FC	
	Chhattisgarh	Nil	Nil	Nil	Nil	Nil	Nil	Nil		
	PGCIL	NA	NA	NA	NA	NA	NA	NA	FC	FC
2015-16	Gujarat	NA	NA	NA	NA	NA	NA	NA	FC	FC
	MP	17	79	76	3	35	16	19	PC	
	Maharashtra	120	251	248	3	225	223	4	PC	
	Chhattisgarh	1	1	1	0	1	1	0	FC	
	PGCIL (WR-I)	6	18	18	0	0	0	0	FC	FC
2016-17	Gujarat	NA	NA	NA	NA	NA	NA	NA	FC	FC
	MP									
	Maharashtra	106	204	198	6	6	2	9	PC	
	Chhattisgarh	Nil	Nil	Nil	Nil	Nil	Nil	Nil		
	PGCIL	NA	NA	NA	NA	NA	NA	NA	FC	FC

Committee noted.

5.2: Relay Setting Database: Hon'ble CERCs order on Grid Disturbance on30.07.2012 &31.07.2012 (PetitionNo. 167/Suo-Motu/2012)

5.2.1) Background:

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

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

5.2.2) 131st PCM discussion:

PGCIL WR-II, Chattisgarh& Goa was requested to submit the data.

5.2.3) 132nd PCM discussion:

For the generators of the states, the forums requested respective SLDCs to co-ordinate and send the data.

Further since the issue is long pending, the forum requested utilities to submit the data as per strict format given by WRPC avoiding merging of cells in the excel format so that the data importing in the database becomes easy and give intimation WRPC.

PGCIL have submitted the data.

Committee requested SLDCs to coordinate with the generators in their system to submit the data to WRPC at the earliest.

Chhattisgarh & Goa may update status.

5.2.3) 133rd PCM discussion:

It was informed that most of the data has been received & the activity of preparing database has been started.

5.2.4) 136th PCM Discussions:

MS,WRPC briefly explained the database that is being prepared by WRPC to the forum. He further informed to the constituents to furnish the data as per the preferred format so that the data import from Excel to the database can be made smoothly. He also informed to the forum that the compiled data base in Excel sheets will be circulated to all the constituents and requested all the constituents to update the data (if any) and furnish the updated data to WRPC.

Committee noted.

ITEM NO. 6: Task Force report

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

Background:

Ministry of Power, GoI constituted a "Task Force on Power System Analysis under Contingencies", in December 2012 under the chairmanship of Shri V. Ramakrishna as per the recommendation made by Enquiry Committee headed by Chairman, CEA on grid disturbances that took place in NEW grid on 30th and 31st July 2012. The terms of reference of Task Force broadly cover analysis of the network behavior under normal conditions and contingencies, review of operational philosophy of protection relays, review of islanding schemes and technological options to improve the performance of the grid. The report of the Task Force was discussed briefly in 122nd PCM and subsequently discussed in detail in a special meeting held on 18.12.2014. Thereafter the recommendations were discussed in the previous PCMs. A brief on suggestions given by Ramakrishna Committee, discussions/observations of the group and PCM are as follows.

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

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

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

6.3) 128th PCM Discussions: It was decided that the tuning of power electronic devices & PSS in WR be carried out by availing the consultancy/training services of IIT-B and a separate meeting be called to deliberate on the modalities of carrying out the PSS tuning activity in WR.

Accordingly a meeting was held on 03.01.2017 at WRPC Mumbai, wherein representatives of all the generating companies, SLDCs and expert from IIT-B attended the meeting.

1) A software for testing the performance analytically would be developed by IIT-B after discussing the requirements with WRPC.

2) A simulation software for exciter/PSS control system simulation shall be developed by IIT-B, which shall be made available to all the generating companies of WR for checking/simulating the frequency response of the PSS

tuned system.
3) The cost of the software at 4 & 5 be funded through WRPC fund.

WRP Committee in the 33rd WRPC meeting held on 01.02.2017, agreed and gave approval for funding the studies software as above from WRPC fund.

6.4) Past PCM updates:
NTPC, Maharashtra Genco and MP Genco representatives informed that the PSS is in-service for all the eligible generators in their system. GSECL representative stated that the PSS tuning activity has been taken up with BHEL. MSPGCL representative stated that they have also initiated the activity of PSS tuning and enquiry has been placed with M/s BHEL.
It was decided that all the generating companies to submit the PSS settings and the step test response plot of time vs terminal voltage in Excel sheets to WRLDC & WRPC.

6.5) 131st PCM discussion:
WRPC informed that there is a need to review the nominations of the study group for taking up studies. Fresh nominations from SLDCs, STUs, PGCIL WR-I & WR-II, NTPC and WRLDC be sought and the network updation/building work be under taken after formation of the group.

6.6) 132nd PCM discussion:
A meeting was held between WRPC & IIT-B in Oct.-2017, wherein IIT-B felt that the scope of involvement of BHEL(OEM of the most of the exciter system in WR) needs to be discussed with BHEL. Also they would study the scope of the work once again after consulting with BHEL. He further informed that IIT-B has recently communicated that they would like to discuss the matter again. WRPC would hold a meeting with IIT-B for deciding the further course of action.
As regards to formation of regional study group, fresh nominations have been sought from SLDCs, STUs, PGCIL WR-I & II, NTPC & WRLDC vide WRPC letter dated 16.04.2018 (enclosed at **Annexure-6.6**)

However nominations have not been received yet. In order to start the above activity nominations from STUs, SLDCs, CTU, WRLDC, State GENCOs, NTPC and IPPs is required to be given to WRPC at the earliest.

6.7) Follow up actions:

(1) NTPC, IIPs & State GENCOs to update on the step response to PCM forum.

(2) SLDCs, STUs, PGCIL WR-I & WR-II, NTPC and WRLDC to give fresh nominations for Special groups for studies and protection coordination for WR.

(3) WRLDC to give a compilation on the step response results in respect of the generators of WR.

6.8) 133rd PCM discussion:
The nominations received for the study group is as follows;

(i)	**NTPC- Shri D. Roy Chowdhary AGM NTPC.**
(ii)	**SLDC Maharashtra- Shri SachinLamte**
(iii)	**MSETCL testing- Shri Vekhade**
(iv)	**TPC-Shri G. T. Jawale**
(v)	**APL-Shri Sandeep**
(vi)	**Reliance-Shri Karekar.**
(vii)	**WRDC-Smt.PushpaSheshadri.**
(viii)	**SLDC MPPTCL-Pradeep Sachan**

GETCO, CSPTCL, PGCIL WR-I & II representatives informed that they would confirm their representation for the study group shortly.

The PSS tuning status received from WRLDC is enclosed at Annexure-6.
6.9) A workshop on PSS tunning activity in WR was arranged in association with IIT-B on 30.08.2018 at WRPC Mumbai. M/s TATA Power, SASAN UMPP, NTPC representative gave presentations. Shri K. Parthasarthi Electronics Division BHEL and Dr.Anil Kulkarni Professor IIT-B who where associated in the PSS tunning of WR in Phase-I & II also gave presentations on the PSS tunning. Around 50 participants attended the workshop, where queries of the participants were answered by Shri K. Parthasarthi Electronics Division BHEL and Dr.Anil Kulkarni Professor IIT-B.
It was stressed that the association of the OEM of the excitation system of the generator is required to be involved in the PSS tunning activity. It was also advised that now PMUs are being deployed in the system and therefore the data (oscillations) recorded by the PMU (during tripping of nearby lines from the generating station) nearby the generation stations can be utilized to decide upon the parameters required to set for PSS. This data can be shared with the OEM of the excitation system, who will then help out in deciding the PSS parameters for tuning it.
Regarding the modalities of taking up the activity in WR, Dr.Anil Kulkarni Professor IIT-B informed that they are working on how to proceed on the development of the software and they would revert back once it is finalized.

6.9) 134th PCM Discussions:
Due to paucity of time the item could not be discussed, therefore the same would be taken up in the next PCM.

6.10) 135th PCM Discussions:

The 1st meeting of the WR Study Group was held on 29.10.2018 at WRPC, wherein it was stressed that the updated network upto 31.09.2018 and the planned network and system data upto March-2019 be submitted to WRPC for taking up the Capacitor Studies.

6.11) 136th PCM Discussions:

MS,WRPC requested to submit the updated network upto 31.09.2018 and the planned network and system data upto March-2019 to WRPC for taking up the Capacitor Studies**.**

Committee noted**.**

ITEM NO 7: SPS

7A) SPS for 765kV Agra-Gwalior for load shedding in NR and automatic generation backing down in WR:

7A.1) Background:

7A.1.1) In the 129th PCM, PCM suggested that the SPS conditions at both Agra and Gwalior end be sensed independently and if SPS conditions at either end are satisfied their shall be independent signal generation and a decision based on the signals generated at both ends should be transmitted to the generators of WR and loads in NR, as the case may be, so that there is adequate redundancy in the SPS. Further as regards to testing the SPS, secondary injection method should be done while carrying out the mock testing of SPS, so that whole SPS except CTs is tested.

7A.1.2) In the 130th PCM, PGCIL representative stated that at present it would be difficult to extend the SPS signal from both Agra and Gwalior ends to all the generators in WR and loads in NR individually. However the exchange of SPS signal generated on meeting of the SPS condition can be exchanged and sent to generators in WR and loads in NR. Further PGCIL confirmed that the exchange would be carried out on Fiber communication.

7A.1.3) Subsequently, NRPC vide letter dated 18.05.2018 (copy attached as **Annexure 7A**) informed that issue of revised SPS scheme was taken up in their OCC meeting and is being implemented at Agra end. NRPC have further informed that they have included the breaker status in the SPS sensing for loss of import of 1000MW & 1500MW at Agra end. PGCIL NR have informed NRPC that they agreed for including breaker status monitoring in the SPS. WRPC have been requested for expediting the inclusion of breaker status in the SPS at Gwalior end also.

7A.1.4) 133rd PCM discussion:

PGCIL representative informed that there are some issues in continuous monitoring of the remote end breaker status at both ends.

It was suggested that instead of continuous monitoring of the breaker status, a signal of tripping of the breaker status can be sent to the remote end which would be incorporated in the SPS logic.

It was decided that both the line breaker status of tripping be sent to remote end and this would be an additional condition for generating the SPS signal, when the loss of import in NR is more than 1000MW to 1500MW, for backing down (in WR) from Gwalior end and Agra end respectively.

7A.1.5)134th PCM Discussions:

Due to paucity of time the item could not be discussed, therefore the same would be taken up in the next PCM.

7A.1.6)135th PCM Discussions:

PGCIL representative informed that a signal of tripping of the breaker status has been incorporated in the SPS logic during the month of January 2019.

7A.1.7)136th PCM Discussions:

PGCIL representative informed that for signal transmission from Gwalior end independently for various conditions of 765kV Gwalior Agra SPS, DTPCs had been commissioned at Gwalior end & respective generators end in Western Region (CGPL, Sasan, NTPC – Vindhyachal & Korba) for generation backing down scheme. He further informed that during the commissioning of the DTPCs end to end testing of signal transmission from Gwalior to respective generators has been carried out and the same was witnessed by the generators. He informed that with this the work related to 765kV Gwalior Agra SPS is completed (Copy of the PGCIL letter dated 01.04.2019 is enclosed as **Annexure - 7A.1.7).**

WRLDC representative informed that the DTPCs end to end testing of signal transmission from Gwalior to respective generators has already been carried out by PGCIL and the same was witnessed by the generators then there is no further need of mock testing of 765kV Gwalior Agra SPS.

Committee noted.

ITEM NO. 8 : WRLDC Items from 129th PCM for follow up:

8.1 Mock Testing of Local and Wide area System Protection Schemes (SPS) in Western Region

8.1.1) Background :

The details of local SPS are as follows :-

1. CGPL SPS
2. Sasan SPS
3. JPL Stage 1 & 2 SPS
4. Essar Mahan SPS
5. Sipat SPS
6. APL Mundra SPS
7. APL Tiroda SPS
8. High Frequency SPS (tripping of Korba Unit 7, Vindhyachal Unit 7, CGPL Unit 40)

Details of Inter-regional SPS Schemes (Wide Area) are as follows:

1. Agra-Gwalior SPS at Gwalior end.
2. HVDC Mundra Mohindergarh SPS

In the 129th PCM it was decided that mock testing of the local SPS can be done without much coordination and therefore WRLDC may prepare a schedule for mock testing of local SPS and carry out the mock testing as per the schedule in coordination with the generators concerned. The Wide Area SPS requires coordination among the inter region, therefore these shall be scheduled in consultation with the NLDC and respective RLDCs.

In the 130th PCM it was decided that wherever the SPS has operated successfully in the recent past, it would not be required to carry out the mock testing of SPS.

In the 132nd PCM, WRLDC representative informed that the Mouda SPS was removed as intimated by NTPC.

8.1.2) 133rd PCM discussion:

No reply was received from NTPC regarding deactivation of Mouda SPS.

8.1.3) 134th PCM discussion:

The updated status of recent successful operation of SPS received from WRLDC is enclosed at **Annexure-8.1.3.**

8.1.4) 135th PCM Discussions:

Committee recommended that WRLDC will prepare a schedule for mock testing of local SPS in consultation with the concern entity. With regard to mock testing of wide area SPS schemes, WRLDC shall prepare the schedule in consultation with NLDC and concern entity. All entity shall furnish their proposed schedule of mock testing of local SPS to WRLDC with intimation to WRPC at the earliest.

8.1.5) 136th PCM Discussions:

New updates:

1. The updated status of recent successful operation of SPS received from WRLDC is enclosed at Annexure-8.1.3 (A).
2. Schedule of mock testing of SPS along with SPS operations (2016-19) as received from WRLDC is enclosed at Annexure-8.1.3 (B).
3. WRLDC vide mail dated 08.05.2019 informed that NTPC, Mouda has given mail regarding discontinuation of SPS and same is enclosed at Annexure-8.1.3 (C).
4. WRLDC vide letter No. WRLDC/SO-002/ 2019-01 dated 02.05.2019 informed that mock test of SPS of Agra – Gwalior was carried out on 01/05/2019. Report on mock test is enclosed at Annexure-8.1.4 (D).

Committee noted.

ITEM NO.9: Notifying violation of CEA Protection (Grid) Standard in case of tripping of inter-regional lines of voltage class 220 kV and above level of WR:

9.1) CEA vide letter dated 30.08.2017, have intimated that following protection standards were reportedly violated in respect of following cases;

a) Non-availability of A/R at both ends of 220kV lines
b) Non-submission of DR/EL data to RLDC within 24 hours of the event.
c) Non-intimation of main reason for the events after its complete analysis.
d) Higher fault clearance time than prescribed in the standards.

CEA has further directed that if the non-compliance of Grid/Standards/ Grid Code continues, the matter may be reported to CERC under provisions of the Grid Code, with a copy of the report to CEA.

In the 130th& 131st PCM, the sub-Committee requested all the utilities concerned to report the compliance to WRLDC/NLDC with a copy to WRPC.

9.2) 133rd PCM discussion:

Committee requested all the utilities of WR to checkup the violations as has been brought out by NPC, CEA and report the compliances at the earliest.

9.3) 134th PCM discussion:

Committee requested all the constituents to submit the action taken report on the above.

WRLDC vide letter dated 11.01.2019 (copy enclosed as **Annexure 9.2)** reported the list of 220 kV and above line trippings in which the CEA Protection standard Violations were observed for the months of Nov &

December 2018. In which the details of Protection Violation such as Delayed Auto reclose operation, Non-operation of Auto reclose and Delayed fault clearance have complied with the help of Voltage plots from PMUs.

9.4) 135th PCM discussions:
Committee requested all the utilities of WR to strictly follow the CEA's protection standard in future in order to ensure safe grid operation.

9.5) 136th PCM discussions:
A report of WRLDC on the above subject covering details from January 19 to March 19 is enclosed at Annexure 9. Committee requested all the utilities of WR to strictly follow the CEA's protection standard in future in order to ensure safe grid operation.

MS ,WRPC observed that most of the constituents are not submitting the DR/EL to WRPC/WRLDC within 24 hours of the event and also observed that few of the 220 KV lines, Auto re-closure facility is not available at either end or both ends.

MS,WRPC requested all the constituents to submit the compliance report on the report of WRLDC indicating violation of CEA Protection (Grid) Standard in case of tripping of inter-regional lines of voltage class 220 kV and above level of WR at the earliest to WRPC.

PGCIL representative informed that they will send the compliance report and DR/EL within 24 hours of the event regularly to WRPC/WRLDC.

ITEM NO. 10: Review of Mumbai Islanding Scheme:

10.1) Background:
Tata Power Mumbai vide letter dated 23.10.2017 requested to review the existing Islanding Scheme.

10.2) 131st PCM discussion:
The sub-Committee discussed the above and felt that there is requirement of shedding additional load of around 400MW so as to match the load with the generation in case the Island separates from the rest of the grid. It was decided to hold a separate meeting on 13.03.2018 by involving TATA, BEST, Reliance-DISCOM, Reliance TRANSCO, MSETCL, WRLDC& WRPC.

10.3) Special Meeting held on 13.03.2018:
Accordingly a meeting was held on 13.03.18 at WRPC Mumbai and the decision taken in the meeting is as follows;

It was decided that if additional 300 MW load is shed then the island can be saved in case of Grid Disturbance.

This additional 300 MW load to be shed, be shared proportionately among TPC and BEST on pro-rata basis peak demands (TPC would share 107 MW and BEST would share 193 MW). It was further requested that these load shedding be implemented as soon as possible. Representatives from TPC and BEST told that wherever Procurement is not required, it will be implemented within a month and wherever procurement will be required, it will take 3-4 months of time.

10.4) 132nd PCM discussion:

TPC representative informed that for existing substations where relays are available, it will be implemented by April 2018 end and where procurement is required, additional 6-8 months of time will be required.

MS WRPC requested TPC & BEST representatives to take up the issue of procurement of UFRs with their management and implement (wire up) the above additional load for shedding as early as possible.

Subsequently, WRPC vide letter dated 12.06.2018 (Copy enclosed as Annexure 11.3) requested TATA Power and BEST to give update at the earliest.

TPC/BEST may update on the above.

10.5) 133rd PCM discussion:

TATA Power representative informed that out of their share of 107MW 90MW has been wired up with the existing UFRs and remaining 17MW would be wired up with the existing UFRs by July 2018 end, as an interim measure. He further informed that meeting with BEST representative was held in 1st week of July 2018, wherein it was decided that 150 MW out of 193MW(total BEST share) would be wired up by August 2018 end. As regards to procurement of additional UFRs the process has been initiated.

A meeting on the Mumbai Islanding scheme was held at CEA New Delhi which was chaired by Chairperson CEA on 10.10.2018. In this meeting all the utilities(Mumbai) were requested to submit the prioritization of the critical loads in their system. The same was submitted to CEA.

10.6) 134th PCM discussion:

TPC representative informed that the load shedding quantum of 200MW has been wired up through existing UFRs.

10.7) Meeting at CEA :

A special meeting to discuss the constraint scenario in Mumbai Transmission System scheme was held on 10.10.2018 at CEA New Delhi, wherein inadequacy in the existing islanding scheme with the increasing imports was discussed. In the meeting it was suggested that it is essential to review the loads included in the category of critical ones and prioritize them for serving in the island with loads pertaining to general public safety giving high priority. It was decided that all the Mumbai DISCOMs would resubmit the details of critical loads along with explanations/ descriptions thereof and their priority for retention in the Island. Each DISCOMs would also broadly categorize the critical load into two groups i.e. shed able load and non-shed able load during Island formation.

The above data was obtained from the DISCOMs in Mumbai(TATA,BEAT & Adani) and was forwarded to CEA New Delhi. The data forwarded is enclosed at Annexure-10.4.

10.8) 136th PCM Discussions:

MS, WRPC informed that after receipt of all the data regarding critical/Non critical loads data from the Mumbai DISCOMs a second meeting was held at CEA New Delhi on 27.02.2019. The MoM of this meeting is enclosed as **Annexure 10.8**.

The gist of deliberations/decisions in the meeting are as under :-

A. It was noted that PPA between TPC and BEST for purchase of power from TATA's generating units, had been extended by another five years. This meant that Tata's generating units which are embedded in Mumbai system would continue to operate for at least another 5 years, thereby strengthening the islanding scheme and facilitating feeding of larger generation of critical load in Mumbai. For effective islanding scheme, embedded generating units should always be kept on bars to meet any contingency and to have minimal dependency on external sources.
B. It was opined that Mumbai being commercial capital of the country, it is essential to maintain security of electricity supply to at least all critical consumers even under grid disturbance. It was also noted that commercial implication of power outage may be much more than the cost of islanding scheme. It was suggested that a strong islanding scheme with adequate generation capacity within Mumbai is essential.

C. **It was noted that keeping in view the present load-generation scenario, it would not be possible to meet the entire critical load with the existing generation within Mumbai. It was suggested that issue of adequate generation within Mumbai for effective Islanding scheme may be decided in WRPC forum. WRPC Secretariat may take action in this regard at the earliest**.

Committee noted as above.

ITEM NO.11 Certificate for Healthiness of Batteries

11.1) Background:

As per the MoP direction given in pursuant to recommendations of the Enquiry Committee (NEW grid disturbance on 30th & 31st July, 2012), RPCs are required to obtain from their respective Constituents the monthly certificate for healthiness of batteries, installed at 220 KV and above voltage level Substations (for power supply to Relays, RTUs and PLCC equipment) and furnish the same to CEA/MoP.

With reference to above, the Constituents are requested to submit the certificate on healthiness of batteries on monthly basis (i.e. status for a month shall be sent by the 7th day of the following month) to WRPC Secretariat.

A format for certificate for healthiness of batteries have sent to the members through email dated 20.04.2018.

11.2) 133rd PCM discussion:

The certificates have been received from KSK Mahanadi, TRN Energy, GSECL/GETCO, MSETCL, TATA Power, Essar Power, Rinfra, NCA, SKS, CGPL, PGCIL WR#2, LANCO, Jaypee Nigrie, NSPCL, GSEL, MCCPL.

11.3) 134th PCM Discussions:

Committee requested constituents to give regular certification of the healthiness of the station batteries.

11.4) 135th PCM Discussions:

The certificates related to healthiness of the station batteries have been received from some of the entities such as KSK Mahanadi, TRN Energy, GSECL/GETCO, MSETCL, TATA Power, Essar Power, Rinfra, NCA, SKS, CGPL, PGCIL WR#2, LANCO, Jaypee Nigrie, NSPCL, GSEL, MCCPL. Committee requested other entities to furnish the certificate immediately and keep sending regularly.

11.5) 136th PCM Discussions:

The certificates have been received from KSK Mahanadi, TRN Energy, GSECL/GETCO, MSETCL, TATA Power, Essar Power, Rinfra, NCA, SKS, CGPL, PGCIL WR#2, LANCO, Jaypee Nigrie, NSPCL, GSEL, MCCPL.

Committee requested other entities to furnish the certificate immediately and keep sending regularly.

Committee noted as above.

ITEM NO. 12: Disturbance occurred at 765/400kV Kotra Pooling Station on 23/04/2018.

12.1) A meeting to discuss and analyze the disturbance occurred at 765/400 kV Kotra PS on 23/04/2018 was held on 09.05.2018 at WRPC Mumbai.

In order to prevent the recurrence of such tripping, the following remedial measures for maintenance activities are recommended for 765/400 kV Kotra substation (of PGCIL) as discussed in the meeting:

(1) As a safety measure, it must be ensured that isolators of adjoining/bordering live areas (which are not part of the dead circuit area) are opened & locked, and the keys of such Isolator marshalling boxes (MB) are deposited with the Control Room (CR) (i.e. permit issuing authority) before commencing the maintenance activities.

(2) Members suggested that it would be a better safety practice to de-energize the auxiliary supply (i.e. remove the fuse and deposit it with permit issuing authority) of the EHV isolation equipment of the adjoining/bordering live areas.

(3) It must be ensured that only well trained and experienced Engineer/Technician/Supervisor/wiremen are allowed for carrying out the EHV maintenance / testing related works.

(4) The safety procedures and guidelines incorporated in Powergrid 'Safety Rule Handbook' and 'Powergrid Safety Instruction documents' should be followed strictly for isolation of dead area (i.e. area with permit to work system for maintenance) from adjoining live areas and other safety aspects for maintenance of EHV substation.

(5) It would be a better practice to incorporate the de-energization of the auxiliary supply of the equipments under maintenance and also for adjoining isolating devices which are separating/bordering the maintenance work area.

(6) Proper training to the officials, responsible for maintenance/ testing activities, must be imparted in accordance with Regulation 7 of CEA (Measures relating to Safety and Electric Supply) Regulations), 2010.

(7) Permit-To-Work (PTW) system as given in IS 5216 (Part-I): "Recommendations on Safety Procedures and Practices in Electrical Work" is to be followed for maintenance activities especially for interlocking and safety procedures.

(8) Two simultaneous activities interfering with one another should not be carried out in a single area which is under maintenance.

12.2) 133rd PCM discussion:

Member Secretary WRPC informed that PGCIL and all other utilities of WR should follow the suggestions and recommendations brought out as above, so that recurrences of such disturbances should be avoided.

WRPC Secretariat informed that in addition to above there are some issues in the protection philosophy and relay settings adopted at Kotra S/S. These issues are as given below;

Protection issues:

(i) At 765 kV Kotra S/S, there is a one and half breaker scheme on 400kV side with 3 CTs. T-section protection is not provided at Kotra S/S. The selectivity as is the practice in PGCIL (as informed by them vide email dtd. 14.05.2018) for 3CT scheme is provided as follows;

(a) looking from the Line/ICT (as the case may be) side, the Bus Section beyond Main bay CB is protected by BB protection &

(b) T section between Main Bay and Tie bay CT is protected by line protection or transformer protection(as the case may be). In this approach there remains a blind zone in case Line side or Bus side Isolator is open. Therefore PGCIL may review this and if possible and providing overlapping protection for T-section be explored where ever 3CT scheme is deployed.

(ii) PGCIL vide email dated 15.05.2018 have informed that protection settings adopted in PGCIL is as per the recommendations in "Rama Krishna Task Force Sub-Committee for Power System Analysis". There is no mention about end zone protection as per the recommendations and therefore the same is not implemented in PGCIL Kotra S/S. The BB protection is of M/s GE(previously ALSTOM) make MICOM P741 type.

Though there is no mention about the End Zone (Dead Zone) protection in the Task Force Sub-Committee for Power System Analysis report, it is a good practice to have this protection enabled

and isolate the fault through this protection and avoid multiple line trippings and clearance of faults from remote ends. PGCIL should incorporate this protection in the BB protection, since the MICOM P 741 has this feature and the entire modern Numerical BB protection scheme have this feature. This would have isolated the fault well before the Zone 2 timings and wide spread of the disturbance would have been avoided. PGCIL may look into it.

(iii) The 765/400kV ICT-I, III & IV backup protection timings at 765kV Kotra S/S needs to be co-ordinated with the Zone-3 timings of the 765kV lines at remote ends. The ICT-I should have tripped from 765kV side backup protection after isolation of the fault from 400kV sides ahead of the Zone -3 timings of the 765kV lines at remote end. PGCIL to review the relay setting coordination.

(iv) There are many 400kV short lines emanating from 765kV Kotra S/S. These are 400kV DB Power D/C-27ms, 400kV Raigarh D/C-6.4kms, 400kV NTPC Lara D/C-19kms, 400kV RKM D/C-20kms, 400kV SKS D/C-27kms. Also, there are long D/C lines followed by short lines. These lines are 400kV Raigarh-Raipur 4 ckts -220kms, 400kV NTPC Lara-Champa D/C-113kms, where it is found that the relay coordination of Zone -2 and Zone-3 is a big issue. Therefore, Line differential relay is required to be provided for these lines to have proper selectivity of the protection.

12.3)134th PCM Discussions:

Due to paucity of time the item could not be discussed, therefore the same would be taken up in the next PCM.

12.4) 135th PCM Discussions:

Committee observed that though there is no mention about the End Zone (Dead Zone) protection in the Task Force Sub-Committee for Power System Analysis report, it is a good practice to have this protection enabled and isolate the fault through this protection and avoid multiple line trippings and clearance of faults from remote ends.

12.5) 136th PCM Discussions:

PGCIL representative informed that Dead Zone Protection feature of Bus bar peripheral unit is dependent on Switchgear position of Circuit Breaker, obtained through Auxiliary Switch, which is a mechanical device and could mal-operate, resulting in incorrect CB status. This would result in incorrect operation of Bus-Bar protection. Hence it is decided to keep Dead zone protection disabled and LBB feature to take care of blind zone. There is no blind zone since any fault between CT and Bus side Isolator (if it is in open condition) is taken care by LBB protection. Thus any fault in this zone will be isolated well before Zone 2 timing. He further informed that the coordination of remote line Zone 3 timings and ICT

backup Overcurrent protection timings is complex and not successful. In view of this, PGCIL have installed Backup Impedance Protection in ICTs from HV and IV side for better coordination.

Committee noted as above

ITEM NO. 13: Details of Protection Audit and Implemented Defence Mechanism -Reg.

13.1) National Power Committee Division (NPC) / CEA vide letter dated 10.09.2018 informed that a meeting was taken by Hon'ble MoSP (IC) on 20.08.2018 to discuss the draft National Electricity Plan. During the discussions CEA has been asked to prepare report and presentations covering aspects of grid reliability and security,especially with respect to grid failure and remedial measures including mechanisms such as is-landing schemes,SPS,UFR,Third Part Protection Audit etc.

NPC/CEA vide letter dated 10.09.2018 requested WRPC, the details in prescribed formats on the following may please be furnished

i. Protection Audit Carried out so far and its observations (Annexure -I (a) and I (b)).
ii. Islanding scheme implemented in the region (Annexure -II).
iii. SPS implemented in the region (Annexure -III).
iv. Status of implementation of AUFLS in the region (Annexure -IV).
v. Status of implementation of df/dt relays & its settings in the region (Annexure -V).

WRPC vide mail dated 12.10.2018 and dated 26.10.2018 requested MSETCL,MPPTCL,CSPTCL,GETCO,Goa Electricity Department (GED), DD, PGCIL , NTPC and DNH to furnish the information sought by NPC vide letter dated 10.09.2018 to WRPC at the earliest. However, information was not received from constituents except WRLDC and MSETCL. The letter & formats received from NPC,CEA is enclosed at **Annexure 13.**

13.2) 135th PCM Discussions:

SE (P), WRPC informed that the details sought by NPC have been received from WRLDC and MSETCL.

He requested MPPTCL, CSPTCL,GETCO, GED, DD, DNH & NTPC to furnish the details in format given at Annexure 13 immediately. PGCIL representative informed that they have furnished the data by mail on 25.02.2019.

13.3) 136th PCM Discussions:

MS, WRPC informed that the details sought by NPC have been received from WRLDC, MSETCL and PGCIL.

He further requested MPPTCL, CSPTCL,GETCO, GED, DD, DNH & NTPC to furnish the details in format given at Annexure 13 immediately.

Committee noted as above.

ITEM NO. 14: Compliance of Commission's order dated 26th March 2018 in Petition No.09/SM/2015.

14.1) Honorable CERC letter issued under file No.ADMN-11017/14/2018-CERC dated. 26.11.2018 (**Annexure 14**) wherein Honorable CERC requested to ensure the Compliance of Commission's order dated 26th March 2018 in Petition No.09/SM/2015 at para 97 had given the following directions.

*" **l.** CTU to deliberate along with CEA on the issue of MILP based transmission planning or any other formal optimization methodology to be used for network planning along with POSOCO, STUs and other stakeholders at RPCs and CTU to file the conclusions at RPC providing suggestion on optimization tool for network planning to used in the Indian context within 6 months of date of issue of this order.*

***r.** The reliability percentage of a SPS Scheme to be considered while calculating TTC shall be discussed at RPC forum. Effective measures should be taken to expedite ISTS and associated intra-State Order in Petition No. 009/SM/2015 Page 59 of 59 Transmission System to reduce dependency on SPS for safe and reliable system operation.*

***s.** RPCs should ensure the reassessment and implementation of identified islanding schemes after deliberation with stakeholders on the recommendations of the consultant. RPCs to identify additional islanding schemes, as required, periodically.*

***t.** RPCs are directed to ensure that periodic audit of relays/protection system is being carried out and file 6 monthly exception reports to Commission. RPCs are directed to bring out a protocol for checking the relay setting, ensuring healthiness of existing protection system and periodicity of carrying out this exercise and file compliance report in this regard within 3 months of issue of this order. RPCs to take up the issue of protection audit and relay setting in transmission system/distribution system within States. The issue should also be raised at Forum of Regulators so that necessary action may be taken at their level also.*

RPCs should re-assess the existing SPS in consultation with stakeholders at RPC Forum."

As regards to ***"l"*** above CTU vide letter dated 23.01.2019(copy enclosed at **Annexure-14.1**), have informed that the matter has been taken up with CEA for convening a meeting to deliberate upon the issue.

14.2) 135th PCM Discussions:

SE (P), WRPC requested all the constituents (GETCO/ MSETCL/ MPPTCL/ CSPTCL/ POWERGRID/ NTPC/ State Gencos and IPPs) to furnish the updated status on the periodic protection audit of their system regularly to WRPC.

14.3) 136th PCM Discussions:

WRLDC representative informed that reliability percentage of a SPS Scheme is not considered while calculating TTC.

Committee noted as above.

ITEM NO. 15: Islanding scheme for Kakrapar Atomic Power Project (KAPP - 3&4) 2x700 MW capacity Nuclear Power Units of NPCIL.

15.1) NPCIL letter no. NPCIL/Trans/2018/M/29 dated 10.10.2018 (copy enclosed as **annexure 15.1**) have requested WRPC for evolving an Islanding scheme for KAPS 3 & 4 so that it can be implemented before the unit start up. WRPC vide letter dated 07.12.2018 (copy enclosed as **annexure 15.2**) requested GETCO, NPCIL, WRLDC to furnish the required information for doing detailed study to evolve the islanding scheme for KAPS 3 & 4. The data required as follows:

1) **Data/details/information to be furnished by NPCIL/KAPS:**
   a) Generation details
      i. Generation trip details.
      ii. Speed control operation of governor.
      iii. UF/LF trip settings.
      iv. Other relevant requirements.
   b) Load details- load to be included in Island.

2) **Data/details/information to be furnished by GETCO:**
   The downstream network & feeder wise loads at the next bus and further downstream low voltage network.

3) **Data/details/information to be furnished by WRLDC:**
Latest network & peak &off-peakloadings of lines emanating from KAPS & adjacent buses.

A meeting was held at KAPS NPCIL on 14.11.2018 to discuss the Islanding scheme. Generator data was received from KAPS NPCIL vide their letter dated 04.01.2019(copy enclosed at **Annexure-15.3**). Data be received from GETCO by mail enclosed at **Annexure-15.4**.

15.2) 135th PCM Discussions:

SE (P), WRPC suggested that a separate meeting would be better to discuss and formulate the Islanding scheme for Kakrapar Atomic Power Project (KAPP - 3&4) 2x700 MW capacity Nuclear Power Units of NPCIL and the date of the meeting could be decided and intimated to NPCIL,GECTO& WRLDC later on .

15.3) 136th PCM Discussions:

A meeting was held on 24.04.2019 at WRPC Mumbai (copy of MoM enclosed at Annexure-15.5) to discuss Islanding scheme for Kakrapar Atomic Power Project (KAPP - 3&4) 2x700 MW capacity Nuclear Power Units of NPCIL.

During the meeting all the participants discussed about the option 1 and option 2 proposed by GETCO.

After detailed discussion, all the participants, agreed to choose option-II for KAPS 3 & 4 islanding out of two options proposed by GETCO.

DNH representative was not present during the meeting.

Committee noted as above.

ITEM NO. 16: Formation of Third-Party Protection Audit Teams (TPPAT) for carrying out third party protection audit in WR.

16.1) The issue of "Formation of Third-Party Protection Audit Teams(TPPAT) for carrying out third party protection audit in WR" was discussed in the 37th WRPC meeting held on 18.12.2018 and it was agreed to form protection audit teams in WR for carrying out the protection audit of S/Ss in WR.

Table –A: Number of members to be nominated with relay testing and coordination background.

Utility	**No. of members to be nominated with relay testing & coordination background**			**Nomination status**
	Genco	Transco	Others	
Maharashtra	1	1	-	TRANSCO 1. Mr- R. H. Satpute Superintending Engineer Design and Protection Dept. GENCO 1. Mr R S Alone EE(Testing)
Madhya Pradesh	1	1	-	GENCO Shri. Hapreet Singh Bomrah, AE. (O &M)
Gujarat	1	1	-	Shri. G.P.Verma,
Chhattisgarh	1	1	-	
PGCIL: W-1	-	3	-	1. Shri Dinesh Reddy, Dy Manager 2. Shri S Naveen, Asst Manager
PGCIL:WR – II	-	3	-	1. ShSachinSavke, Asst. Manager – Jabalpur PS 2. Sh. Pramod Pathak, Asst. Manager – Navsari 3. Sh. Kumar Siddhant, Asst. Manager – Navsari
NTPC	3	-	-	1.Shri R K Aash rkaash@ntpc.co.in 9429408449 2.Shri S K Waryani skwaryani@ntpc.co.in 8275045135 3.Shri Umesh Kumar umeshkumar03@ntpc.co.in 6265530641
IPP : APL	1	-	-	
IPP : CGPL/TATA	1	-	-	
IPP: SASAN	1	-	-	
SSP/NCA	1	-	-	
WRLDC	-	-	2	Shri. Selvamani Prabaharan M and Shri. M. Venkateswara Rao

Table-B : Number of teams, its composition and duties.

Sl No.	Team	Composition	System to be audited
1	Team -I	1. Gujarat Transco -1 2. Gujarat Genco – 1 3. PGCIL – 1 4. NTPC -1 5. DNH-1	• Maharashtra • IIP S/Ss
2	Team – II	1. MP Transco – 1 2. MP Genco -1 3. PGCIL – 2 4. NTPC -2 5. APL	• Gujarat • Chhattisgarh
3	Team – III	1. Maharashtra Transco - 1 2. Maharashtra Genco -2 3. PGCIL 2 4. NTPC-3 5. SASAN 6. Goa	• Madhya Pradesh • PGCIL
4	Team – IV	1. Chhattisgarh Transco – 1 2. Chhattisgarh Genco – 2 3. CGPL/TATA 4. DD -1 5. SSP – 1 & NPCIL - 1	• Goa • DD • DNH • NHPC • NPCIL • NTPC

WRPC vide mail dated 08.01.2019 requested all constituents to give the nomination so that the work of protection audit can be initiated latest by 15.01.2019. Nominations have been received from PGCIL WR-II & NTPC only. The other constituents in Table-A may give the nominations at the earliest.

16.2) 135th PCM Discussions:

During the meeting it was decided, the details of protection audit teams in WR for carrying out the protection audit of S/Ss in WR to be circulated to the constituents by mail and the constituents has to send their nominations to WRPC before the next PCM.

16.3) 136th PCM Discussions:

WRPC representative informed that the details of protection audit teams in WR for carrying out the protection audit of S/Ss in WR has been circulated to the constituents by mail (prc-wrpc@nic.in) dated 08.01.2019 and 19.03.2019. However, nominations are still awaited from all constituents except PGCIL and NTPC.

WRLDC representative informed that Shri. Selvamani Prabaharan M and Shri. M. Venkateswara Rao will be part of the Third-Party Protection Audit Teams(TPPAT) from WRLDC.

NTPC representative informed that due to transfer of employees in the recent times they will intimate the new nominations to WRPC after consulting with their management.

MS,WRPC requested all the constituents to furnish their nominations at the earliest to WRPC so that the third party protection audit in WR can be started.

ITEM NO. 17: Status of implementation of Enquiry Committee recommendations

17.1) NPC, CEA vide letter no 7/GSC/NPC/CEA/2019/87-93 dated 16.01.2019 (**annexure -17.1**) requested to submit the updated status of implementation of Enquiry Committee recommendations. The last updated information of all constituents is enclosed as **annexure -17.2**. All the constituents are requested to update information and submit the updated information (**in excel format** enclosed as **annexure 17.3**) to WRPC, so that the same can be furnished to NPC, CEA. WRPC, vide mail dated 25.01.2019 (prc-wrpc@nic.in) requested the constituents to submit the updated status of implementation of Enquiry Committee recommendations at the earliest to WRPC.

17.2) 135th PCM Discussions:

All the constituents are requested to submit the updated status of implementation of Enquiry Committee recommendations at the earliest to WRPC.

17.3) 136th PCM Discussions:

WRPC representative informed that the data has not received from the constituents except PGCIL WR-I and SLDC Gujarat.

WRLDC representative informed that they will furnish the required data at the earliest to WRPC.

MS, WRPC informed to the forum that NPC,CEA consistently following up the subject matter with WRPC.

MS,WRPC requested all the constituents consider the subject matter as priority and to submit the updated status of implementation of Enquiry Committee recommendations at the earliest to WRPC.

Committee noted as above.

ITEM NO. 18: Other issues

18.1 AR relay issue of tie-bay of Ranchodpura#1 (GETCO) feeder at Dehgam

PGCIL WR-II vide letter dated 22.11.2017, requested to discuss the status of rectification of AR relay of tie-bay of Ranchodpura#1 (GETCO) feeder at Dehgam. AR relay of tie-bay of Ranchodpura#1 (GETCO) feeder at Dehgam is faulty since quite long.

18.1.1) 131st PCM discussion:

GETCO representative stated that the faulty Siemens make A/R is out and the matter has been taken up with Siemens. By March 18 end Siemens would submit their views.

18.1.2) 132nd PCM discussion:

GETCO representative stated that Siemens have informed them that the A/R is beyond repairs and they are planning to procure new A/R. However retrofitting of panel is required for installation of the new relay.

It was informed that the Siemens make 7VK type relays are available and can be procured to avoid retrofitting the panel.

18.1.3) 133rd PCM discussion:

GETCO representative informed that they have planned replacement of the A/R function through external A/R B-127 spare function. Last week they have sought outage for replacement. However the outage was not given.

Committee suggested that GECTO may carry out the replacement work during the next opportunistic outage.

18.1.4) 134th PCM Discussions:

Due to paucity of time the item could not be discussed. therefore, the same would be taken up in the next PCM.

18.1.5) 135th PCM Discussions:

Committee suggested that GECTO may carry out the replacement work during the next opportunistic outage.

18.1.6) 136th PCM Discussions:

GETCO representative informed that they will propose for the outage in the next OCC meeting and will carry out the replacement work during the outage.

18.2) Settings of 132 KV Morwa and Waidhan feeders from NTPC TPS Vindhyachal.

18.2.1) : Background

- MPPTCL have informed that there are two nos. 132 KV feeders radiating from Vindhyachal TPS viz. Morwa and Waidan. The above lines trips on transient faults of other feeders connected with 132 KV S/S Morwa and Waidhan. It has been informed that at Vindhyachal TPS Zone –I line setting of above lines covers 50 % of next section.
- It is, therefore, requested to instruct Vindhyachal TPS to review above setting of Zone-1 to avoid unnecessary tripping / interruption at 132 KV S/S Morwa and Waidhan.

18.2.2) 133rd PCM discussion:

NTPC representative informed that they would require directions from PCM forum in this matter.

Committee opined that there are standard guidelines for line protection and NTPC should implement the standard guidelines for line distance protection for the above lines immediately.

18.2.3) 134th PCM Discussions:

Due to paucity of time the item could not be discussed, therefore the same would be taken up in the next PCM.

18.2.4) 135th PCM Discussions:

NTPC representative informed that they will coordinate with the management of MPPTCL and resolve the issue at the earliest.

18.2.5) 136th PCM Discussions:

MPPTCL representative was not present during the meeting.

NTPC representative informed that they will coordinate with the management of MPPTCL and resolve the issue at the earliest.

Committee noted as above.

ITEM NO. 19: Installation of back up impedance relay as per Ramakrishna Committee recommendations: -

During the 135th PCM meeting PGCIL,WR-II representative requested the sub committeeto include the subject "Installation of back up impedance relay"matter for discussion among all constituents of sub committee and the details of the susubject matter are as follows:

"As per Ramakrishna Committee recommendation on Power Ssytem analysis under contingencies, Zone 3 reach setting of the Transmission line is to be set so as to cover longest line at next bus with a margin of 20 %. However, in such case where Zone-3 reach is set to enter into next lower voltage level, Zone-3 timing shall be coordinated with the back-up protection (Directional over current and earth fault relay) of power transformer. Where such coordination cannot be realized, it is recommended to carry out simulation studies for relay reach & time coordination and suitable solution may be devised.
Some of the typical solution can be like application of back up distance protection for power transformer, duplicated protection for downstream 220kV feeders or special protection scheme logic. C opy of the relevant pages is attached as annexure 19."

135th PCM Discussions:
MSETCL representative opined that application of back up distance protection for power transformer as in the above case may help in isolation of the fault ahead of the Zone -3 timings of the lines at remote endduring certain type of faults.

PGCIL representative informed that installation of back up impedance relay has been taken up by POWERGRID,WR-I. Wherein, the first stage, both over current and back up impedance will remain in service and after some time (stabilization of back up impedance relays), over current relays will be taken out of service.

136th PCM Discussions:
PGCIL representative informed that installation of back up impedance relay was completed.

Committee noted.

ITEM NO. 20: Date and venue of the next meeting

Date and venue of 137th PCM meeting will be intimated separately.