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भारत सरकार
विद्युत मंत्रालय
उत्तर क्षेत्रीय विद्युत समिति
-18ए, श.जीत सिंह मार्ग,कटवारिया सराय ,
नई दिल्ली110016 -
Government of India,
Ministry of Power
Northern Regional Power Committee
18-A, S. Jeet Singh Marg, Katwaria Sarai,
New Delhi-110016

No. NRPC/OPR/107/01/2016/ ***Dated: 22.11.2016***

फैक्स संदेश /***FAX MESSAGE***

From : अधीक्षण अभियंता (ऑपरेशन), एन आर पी सी /Superintending Engineer (O), NRPC.

To : **संरक्षण उप समिति के सदस्य** (**सूची के अनुसार**)/ Members of Protection Sub-Committee (As per List)

विषय: 32 वीं संरक्षण उप समिति की बैठक के लिए एजेंडा

Sub : Agenda for 32nd Protection Sub-Committee meeting

The 32nd meeting of Protection Sub-Committee will be held on on 30.11.2016 at 10:00 hrs. at **Hotel Best Western Indraprastha Resort, Strawberry Hills, Naddi, Mcleodganj, Dharamshala (HP).** The agenda for the meeting is available on NRPC website and same can be downloaded from http://www.nrpc.gov.in

Sd/-
(अजय तळेगावकर)/(Ajay Talegaonkar)
अधीक्षण अभियंता (प्रचालन) एवं सयोजक सदस्य, **संरक्षण उप समिति**
SE (operations) & Member Convener, Protection Sub-Committee

List of Members of Protection Sub-Committee

1. Director (P&C)/BBMB, Chandigarh, Fax-0172-2652054
2. General Manager (SLDC), DTL, Fax No 011-23236462
3. GM (O&M), Delhi Transco Limited, New Delhi, Fax-011-23236462
4. GM (T), Common Services IPGCL, New Delhi, Fax-23370247
5. Chief Engineer (TS), HVPNL, Panchkula, Fax-0172-2591244
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9. SE(T&C), PTCUL, Fax No 0135-2451826
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13. SE (PR& ALDC), HPSEB Ltd., Fax-0177-2837143
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16. Chief Engineer (P&M), PSTCL, Ludhiana, Fax-0161-2741280, 2451491
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18. SE (GM) KSTPS, RVUN, Kota (Rajasthan), Fax-0141-2744521
19. Chief Engineer (LD); RRVPNL, SE (SO&LD) – Fax- 0141-2740920
20. Superintending Engineer (T&C), UPPCL, Meerut (U.P.), Fax-0121-2666062
21. Chief Engineer, (L-2), UPRVUNL Lucknow, Fax-0522-2287822, 2287880
22. DGM (T&C), PTCUL, Dehradun, Fax-0135-2760331
23. Chief Engineer (O&M), NHPC, Faridabad, Fax-0129-2272413
24. NPCIL
    (i) Maintenance Superintendent, NAPS, Narora, Fax- 05734-222167
    (ii) Maintenance Superintendent, RAPS, Rawatbhata, Fax- 01475-242060
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NORTHERN REGIONAL POWER COMMITTEE

AGENDA

FOR

32nd Meeting of Protection Sub-committee

Time of meeting : 10.00 Hrs.

Date of meeting : 30th November, 2016

Venue : Mcleodganj, Dharamshala (HP)

A.1 Confirmation of minutes of 31st meeting of protection sub-committee

Minutes of 31st meeting of Protection Sub-committee were issued vide letter of even no. dated 18.11.2016. The Minutes are available on NRPC's website at http://www.nrpc.gov.in**.** The sub-Committee may confirm the same.

A.2 Follow up action on outstanding issues from previous meetings

A.2.1 Non-functional carrier-inter-trip feature

In the 23rd PSC meeting, BBMB had intimated that carrier-inter-trip feature (Carrier aided protection of transmission line) of following lines was disabled due to faulty PLCC channels (at PSTCL and HVPNL ends). Status as updated in 31st PSC is as under:

Sr.No	Transmission Line (220 KV)	Other end	Status as updated in 31st PSC
1	Jamalpur-Dhandari-I&II	PSTCL	PLCC has been tested and found functional for 220 kV Jamalpur-Dhandari-I. For ckt-II both the ends are ready and end-to-end testing has also been carried out. However, PSTCL stated that work to be done by BBMB related to DTPCC was pending. **Representative of BBMB had stated that they would call a meeting to resolve this issue. PSC had expressed concern and requested BBMB to resolve the issue within 15 days and submit the joint testing report of the same to NRPC Sectt. BBMB and PSTCL had agreed for the same.**
2	Barnala–Lehra-Mohabbat	PSPCL	PSTCL had stated that ownership of this line belongs to BBMB and so is the

			ownership of the equipments at both ends. He had further stated that BBMB should initiate the action to complete the PLCC at both ends. Howerver, BBMB had countered his view. SE(O), NRPC had requested both the parties to resove the issue bilaterally. **BBMB and PSTCL had agreed to sort out this issue within 15 days. SE(O), NRPC had requested BBMB to submit a report on this issue to NRPC Sectt.**
5	Samaypur-Badshahpur	HVPNL	In the 30th PSC meeting, HVPNL had informed that carrier-inter-trip feature on these lines would be functional by 31.03.2016. **In 31st PSC meeting, representative of HVPNL had informed that it had not yet been commissioned. PCC had expressed concern over this issue and had requested HVPNL to expedite action so that same gets completed within a month. Representative of had HVPNL agreed for the same.**
6	Samaypur-Palwal-I&II	HVPNL	

HHVPNL, PSTCL and BBMB may update the status.

A.2.2 Non- availability/ defective PLCC link of STU Lines terminated at

POWERGRID (NR-2) substations

POWERGIRD had submitted a list of sub-station in 22nd PSC meeting where PLCC was non-functional at other side. The list as updated in 31st PSC meeting is enclosed as **Annex-I**. **In the 29th PSC meeting, it was decided that even if PLCC is non-functional, auto-reclosure should be kept operational.**

POWERGRID, PSTCL and PDD J&K may update the status

A.2.3 Auto Re-closure issues related to NTPC- Unchahar

The status as updated in the meeting is as follows:

Station/Line	Issue	Status as updated by NTPC
Kanpur S/s		
220kV Kanpur-Unchahar-I	Auto re-closure scheme was not functional at Unchahar end.	Would be set right by June, 2016 along with the installation of numerical relays.
220kV Kanpur-Unchahar-II		
220kV Kanpur-Unchahar-III		
220kV Kanpur-Unchahar-IV		

NTPC may update the status.

A.2.4 PLCC and Auto Re-closure issues related to UPPTCL

In 28th PSC meeting, POWERGRID had informed that there were various lines of UPPTCL wherein PLCC panels and auto re-closure schemes were not in working condition due to which frequent tripping of lines on transient faults were taking place.

The status as updated in the 31st PSC meeting is as below:

S. No.	Name of Line	Details of PLCC	Status
A.	**Allahabad S/s**		
1.	220kV Allahabad-Rewa Road-I	PLCC link is through but fail frequently due to not availability of wave trap at Rewa Road end. In earlier meeting,	In the 30th PSC meeting it was informed that Wave trap was not available at s/s. It was expected by October, 2015. **In 31st PSC meeting, representative of**
2.	220kV Allahabad-Rewa Road-II		

		it was informed that Wave Trap was being procured and scheme would be functional by March, 2015. In this meeting, no update was given	**UPPTCL could not provide updated status.**
B.	**Kanpur S/s**		
1.	220kV Kanpur-Mainpuri	PLCC panels are not available	**The representatives of UPPTCL present in 31st PSC meeting could not provide the updated status.**
2.	220kV Kanpur-Naubasta		
3.	220kV Kanpur-Panki-I		
4.	220kV Kanpur-Panki-II		
5.	220kV Kanpur-Orai		
C.	**Mainpuri S/s**		
1.	220kV Mainpuri-Etah	PLCC panels are not available	
2.	220kV Mainpuri-Mainpuri(UP)-I		
3.	220kV Mainpuri-Mainpuri(UP)-I		
4.	220kV Mainpuri-Ferozabad		
D.	**400/220kV Lucknow S/s**		
1.	220kV Lucknow-Sitapur	In earlier meeting, it was informed that PLCC available but tele-protection and auto reclosing features were not available in the relay.	It was informed in the 30th PSC meeting that LILO of the line is being carried out at Bakshi Ka Talab. PLCC panel was ready for commissioning and was to be commissioned in the next shut down of the s/s. **In 31st PSC meeting, representatives of UPPTCL could not provide the updated status.**
2.	220kV Lucknow-Chinhat	In earlier meeting, it was informed that PLCC and A/R was functional and testing was required.	It is functional as stated by UPPTCL. POWERGRID would confirm the same within one month. (Later POWERGRID vide email dated 09.11.2016 has

			confirmed that PLCC and auto-reclosure on this line is in working condition)
D.	**Gorakhpur S/s**		
1.	220kV Gorakhpur-Barhua	PLCC is not functional	**Earlier it was informed that PLCC panel was expected by June, 2016. The representatives of UPPTCL present in the meeting could not provide the updated status.**
2.	220kV Gorakhpur-Basti	PLCC panels are not available	
E.	**Merrut S/s**		
1.	220kV Merrut-Gajraula	PLCC is not functional	
2.	220kV Merrut-Nehtaur		
F.	**Rai Bareilly S/s**		
1.	220kV Rai Bareilly-Sarojini Nagar	In earlier meeting, it was informed that Protection panels had been arranged for 220kV Rai Bareilly-Sarojininagar line, which was being installed.	**The representatives of UPPTCL present in the meeting could not provide the updated status.**

It was decided in 31st PSC that UPPTCL would submit updated status within one month. No report has been recived at NRPc Sectt.
UPPTCL may update the status

A.2.6 Islanding scheme for Rajasthan, Haryana and Punjab

A.2.6.1 In the 29th PSC meeting, it was decided that RVPNL would operationalize the existing islanding scheme meant for RAPP-A and RAPP-B excluding Mahi HPS till the results of dynamic simulation studies are received from CPRI. If simulation reveals that islanding would function well with inclusion of Mahi HEP, RVPNL can go ahead with their proposal of including Mahi HEP in the scheme.

In the 30th PSC meeting, representative of RVPNL had stated that existing islanding scheme meant for RAPP-A and RAPP-B would change entirely if Mahi HPS is excluded from the scheme. Also, result of dynamic simulation studies had not yet been received from CPRI. RVPNL was requested to implement the scheme provisionally & necessary actions for procurement of relays etc. was to be initiated with completion target of one year. RRVPNL had agreed for the same.

In 31st PSC meeting, representative of RVPNL stated that the procurement process for this islanding scheme was underway and the scheme, without considering Mahi, was expected to be functional by December, 2016.

A.2.6.2 The islanding scheme for the state of Haryana was discussed in the 26th meeting of PSC, wherein it was observed that difference in the estimated available generation and load in the island was too small and therefore the island, if formed, might not survive. A request was made to HVPNL to discuss the scheme with NTPC as their Faridabad gas station was part of the proposed islanding scheme. HVPNL had agreed to review the scheme. In the 27th PSC meeting, certain suggestions were made for proposed islanding scheme. In 28th PSC meeting, HVPNL had informed that changes suggested by PSC were under consideration.

In the 30th PSC PSC meeting, HVPNL again stated that changes suggested by PSC are under consideration and they will submit the concrete result by the next PSC meeting.

In 31st PSC representative of HVPNL again stated that the changes suggested by PSC were under consideration by the higher authorities. **PSC expressed concern over this long pending issue and requested HVPNL to finalise the scheme and sumit the same to NRLDC/NRPC Sectt. within fifteen days. HVPNL had agreed for the same.**

The scheme has not been recived at NRPC Sectt.

HVPNL may update the status.

A.2.6.3 A meeting was held on 27th November, 2014 at NRPC Secretariat to review the islanding schemes for Punjab. In this meeting, it was decided that PSTCL would implement the scheme envisaged for Lehra Mohhabat TPS and Bhatinda TPS at first instance. Thereafter, based on the experience of such scheme, the islanding scheme meant for Ropar TPS would be implemented. PSTCL had informed that stability study for the scheme was being carried out by CPRI and report of the same would be available by 31.12.2014. Thereafter, procurement would start. In the last PSC meeting, PSTCL had informed that report was awaited from CPRI. The report was expected by February 2015. It was expected that the scheme would get implemented by September 2015.

In 30th PSC meeting, PSTCL had informed that CPRI has submitted the dynamic study for islanding scheme for Bhantida TPS and PSTCL was under process of implementing the scheme. Procurement process was underway and the scheme would get implemented by 30.11.2015. PSTCL was requested to share the approved scheme with NRPC Sectt. and NRLDC. PSTCL had agreed for the same.

In 31st PSC representative of PSTCL had informed that relays for islanding scheme of Bhantida TPS had already been procured and installation of these relays was under process. He further stated that the scheme would be made

functional by 30.09.2016.

PSTCL may update the status.

A.3 Progress of rectification of deficiencies observed/improvements suggested in Basic Protection Audit.

The status of rectification of rectification of deficiencies observed in Basic Protection Audit carried out by POWERGRID & CPRI is to be submitted on monthly basis.

The abstract in regard to expected completion time of rectification of protection related deficiencies as informed by utilities is enclosed as **Annex-II**.

Utilties are requested to update the latest status.

A.4 Third Party Protection Audit by the Protection Experts for intra-state system/ balance system not covered in Basic Protection Audit.

The summarised status of TPPA as available with NRPC is enclosed as **Annex-III.** Utilties were requested to update the status and submit the time bound action plan for rectifications of deficiencies.

Utilities may update the status.

A.5 Status of Bus Bar protection

During earlier PSC meetings, utilities were requested to update the status of Bus Bar Protection available with NRPC secretariat. Updated status is enclosed as **Annex-IV.** Utilities were requested to expedite the implementation of Bus Bar Protection schemes and submit the information.

Members may update the status and deliberate so as to expedite the implementation of Bus Bar Protection and submit the information to NRPC Sectt.

A.6 Implementation of Recommendations of the Task Force

As a follow up of one of the recommendations of Enquiry Committee headed by Chairperson, CEA on grid disturbances that took place on 30th and 31st July 2012, Ministry of Power had constituted a 'Task Force on Power System Analysis under Contingencies' in December 2012. The Task Force had submitted its report in August 2013. In a meeting taken by Secretary (Power), GoI on 11.03.2014, it was decide that the report be given wide circulation and its recommendations be implemented in a time bound manner. The report of the Task Force as also Guidelines for Protection settings recommended by the Task force had been uploaded on NRPC website (links

http://www.nrpc.gov.in/reports/other/taskforce_analysis.pdf and http://www.nrpc.gov.in /reports/other/ps_guidelines.pdf). Member Secretary, NRPC vide letter dated 31st July 2014 had requested members of NRPC to initiate action for implementation of recommendations of the Task Force. Some of the issues arising out of recommendations of the Task Force were as under:

A.6.1 **Database of protection settings**

Based on the recommendations of the Task Force, it was decided that data regarding settings of relays shall be compiled by the CTU and STUs in their respective network and furnished to RLDC and SLDC respectively with a copy to RPC for maintaining the database. The database was to be kept updated and verified during the audit.

It was agreed in 27th PSC meeting that CTU would design a format to collect the database and this format may also be forwarded to the STUs so as to bring the uniformity as far as possible.

In the 30th PSC meeting held in September 2015, representative of POWERGRID had presented a format which was agreeable to the members. It was suggested that to begin with the data may be uploaded in pdf for viewing purpose only and also for the system of 400 kV and above. It was also stated that if any change takes place at any location, it shall be updated by uploading the new file. This format was made available as MS-Excel file at NRPC website.

In 31st PSC meeting it was noted that none of the Utilities had submitted the information. Members agreed to submit the information at 400 kV level within a month.

The issue was discussed in 34th TCC/38th NRPC meeting held on 24th /25th October, 2016 wherein it was decided that protection setting data will be provided by all the utilities within 02 months for 400kV and 220kV S/S. However, no data has been recived so far.

Members may deliberate about constraints, if any with the view to comply with the decision of NRPC.

A.6.2 **Zone-III settings**

During the interaction (10-14 August 2015) with the consultants appointed by the CTU to review the status of implementation of Enquiry Committee recommendations, while POWERGRID had confirmed that they have reviewed the Zone-III settings in line with recommendations of the Task Force, generating companies like NTPC and NHPC had informed that POWERGRID had not advised them about revision in settings, if any, in their switchyard. Considering

that the issue is directly linked with the safety and security of the grid, POWERGRID vide letter no.-NRPC/OPR/105/11/2015/1051-55 dated 02.09.2015 was requested to coordinate with entities at other end of their transmission lines for Zone-III settings **(copy was enclosed as Annex-V of the agenda).** In the aforesaid letter, POWERGRID was also requested to confirm about implementation of all the recommendations of the Task Force to the NRPC Sectt.

In 30th PSC meeting, representative of POWERGRID had agreed to provide all the infeed data of their lines to the concerned generating companies so as to review the Zone-III settings in line with recommendations of the Task Force. The generating companies were requested to carry out the calculations for the revised settings for their switchyard and get it reviewed/reconciled by POWERGRID. However, on the issue of the latter, representative of POWERGRID stated that they will take up this matter with their higher management and revert back to NRPC Sectt.

POWERGRID vide letter no. NR-1/NRPC/Zone-3/6824 dated 01.10.2015 had made following submissions:

- They had reviewed Zone-3 settings of all feeders emanating from its stations in 2012 after twin grid failure of July, 2012.
- Subsequently, POWERGRID had reviewed and implemented the relay setting of all lines emanating from its stations as per recommendation of "Sub Committee on Relay/Protection under Task force for Power System Analysis under Contigencies".
- For setting of Back-up zones & Back-up protection of Line & Transformer,POWERGRID had obtained the data from remote and stations(i.e. shortest/longest line emanating from remote, no. of transformers along with % impedance etc.) for setting coordination.
- Reviewing/Modification of Relay settings is not one time exercise and needs regular check whenever any new transmission element is commissioned.
- Guidelines are already available as per above referred Task Force Recommendations in Public domain.
- The Utilities at the other end of lines emanating from POWERGRID sub-stations may also be advised to review of Zone-III sttings as per above referred Task Force Recommendations at their end. POWERGRID is willing to provide necessary input parameters/fault data for settings calculations by such utilities as per their request.

In 31st PSC representative of NTPC had raised practical difficulties in coordinating IDMT back up protection of remote transformers with definite time remote back up by Zone-3 element of line. He had opined that system studies with different infeed conditions and verification of new setting needs to be carried out so that the intended purpose is achieved and meets the system performance requirements with respect to fault clearing time, transient stability

etc. He had requested that a group may be formed involving CTU / STU for verification of Zone-3 & back up O/C & E/F setting after due system studies till then the previous setting may be retained.

Representative of POWERGRID had stated that they would provide necessary input parameters/fault data for settings calculations by such utilities as per their request.

PSC had decided that the setting of Zone-III would be carried out by the concerned utility at their end. The utltiy at other end would provide all the required parameter. The utilties can share the Zone-III setting so arrived at with each other and with PSC for better cooridination. The issues, if any would be deliberated in the PSC.

No issues have been reported so far.

A.7 Final report of the group to suggest measures for bringing improvement in the field of Power System Protection among the utilities in Northern Region

A group was constituted by Member Secretary, NRPC vide letter No. NRPC/OPR/107/06/ 2015/ dated: 26.08.2015 to suggest measures for bringing improvement in the field of Power System Protection among the utilities in Northern Region. The group prepared the draft by means of communication through e-mails amongst the members of the group. Further, the draft report of the group was discussed and deliberated in the 30th PSC meeting wherein PSC had given in-principle approval of the recommendations of the group for further approval by TCC/NRPC. Finally, the meeting of the group was held on 21.04.2016 at NRPC Secretariat in order to iron out the minor differences on some issues.
The report was recommended in the 31st PSC meeting for approval of NRPC. The report was submitted in 34th TCC/38th NRPC meeting held on 24th /25th October, 2016 wherein the report was accepted for implementation. It was also decided that a group comprising members from HP, Delhi, UP, POWERGRID and NRPC Secretariat would be constituted for deciding common guidelines for reward scheme.

In line with the recommendation of the group first training programme of Level-I was conducted successfully from 21st to 25th November, 2016.

This is for the information of the PSC.

A.8 Transient dated 16/05/2016 at Rawatbhata, Rajasthan Site

IN the 31st PSC meeting, representative of NPCIL had informed that on 16.05.2016, a CT failure on 220kV RAPS-3&4-RAPS-5&6 S/c line led to tripping of all the four operating units. RAPS-2 was under outage. It was stated that last year on 19/05/2015, a CT failure on 220kV RAPS-3&4-Chittor line-2 had created

a fault and led to tripping of all the five operating units. This event was discussed in the 30th Protection Sub-Committee meeting, wherein it was agreed to revise zone-2 time settings of 220kV Anta-RAPS-5&6 S/c line to 600ms, in line with recommendations of "CEA Task Force dated Aug.2013". Anta was requested to confirm the implementation of the agreed setting. The proposed revised settings as per NPCIL review of the latest incident were informed as under:

Sr.	Setting Parameter	Settings proposed vide 30th NRPC Sub-Committee Meeting	Settings proposed by NPCIL
1.	Zone-2 time delay of RAPS-5&6 Anta line at Anta end.	600 msec.	600 msec.
2.	Zone-4 time delay of RAPS-5&6 Anta line at RAPS-5&6 end	450 msec.	450 msec.
3.	Back up Directional Over current protection (67) at RAPS-5&6 end. i. Characteristic ii. Current Setting iii. Time Delay	 DT 5In 450 msec.	 DT 3In 350 msec.
4.	Back up Directional Over current protection(67N) at RAPS-5&6 end. i. Characteristic ii. Current Setting iii. Time Delay	 DT 0.2In 450 msec.	 DT 0.2In 350 msec.
5.	Back up Directional Over current protection (67) at RAPS-3&4 end. i. Characteristic ii. Current Setting iii. Time Delay	 DT 5In 550 msec.	 DT 3In 450 msec.
6.	Back up Directional Over current protection(67N) at RAPS-3&4 end. i. Characteristic ii. Current Setting iii. Time Delay	 DT 0.2In 550 msec.	 DT 0.2In 450 msec.
7.	Zone-2 time delay at remote end for all 220kV lines emanating from RAPS-3&4	500-600 msec	600 msec.
8.	Zone-4 time delay at RAPS-3&4 end for all 220kV	450 sec.	600 sec.

	lines emanating from RAPS-3&4		

In 31st PSC members were requested to dwell upon the setting proposed by NPCIL and give their comment in the next protection sub-committee meeting.

Members may deliberate

A.9 Transient dated 19/05/2016 at RAPS-3&4

On the given day at 13:59 hrs, all the four 220kV lines (2ckts. to Chittor, 1ckt. each to Kota and Udaipur) tripped sequentially due to heavy sparking at Chittor end. This led to tripping of RAPS-3 on over frequency while RAPS-4 survived on house-load, which could be synchronized at 14:43 hrs with lines to Kota and Udiapur. The concerned agency may be advised to present the case with transient progression, protection operated and the relevant relay indications etc.

In 31st PSC RRVPNL and NPCIL were requested to dicuss the issue bilaterly and submit the report in the next protection sub-committee meeting.

NPCIL and RRVPNL may update the status.

A.10 Line Differential Protection (Agenda from National Power Committee)

One of the recommendations of the Sub-Committee on Relay/Protection under task Force for Power System Analysis under contingencies with regard to line differential protection is as under:

" Many transmission lines are now having OPGW or separate optic fibre laid for the communication. Where ever such facilities are available, it is recommended to have the line differential protection as Main-I protection with distance protection as backup(built-in Main relay or standalone). Main-II protection shall continue to be distance protection. For cables and composite lines,line differential protection with built in distance back up shall be applied as Main-I protection and distance relay as Main-II protection. Auto-recloser shall be blocked for faults in the cables."

Members may deliberate on the reommendation of the committee.

A.11 CERC order on Petition no 9/SM/2014 and 10/SM/2014

CERC in its oder dated 14.06.2016 on Petition no 9/SM/2014 for Investigation of tower collapse and load crash in Northern Region on 30.5.2014 and Petition no 10/SM/2014 for Investigation of Line Outage due to Tower Collapse in

Northern Region on during April 2015 to June 2015 directed RPC Secretariat to examine the cases of delayed clearance of faults on transmission system during last two years and to submit an anaylsis report within six month from the date of issue of the order. The summarised status of the delayed clearance of the fault from 01.04.2014 to 01.06.2015 is enclosed as **Annex-VI**. Utilties are requested to submit the following

- Utilties which have not submitted the detailed report alongwith the remedial measures taken/being taken are requested to submit the same.

- Utilties whosoever have submitted the report alongwith the measures to avoid the recurrances of these types of tripping are requested to submit the status of action suggested in report.

Members may deliberate

A.12 Creation of Protection Analysis Sub-Group (PSAG)

It was submitted in 31st PSC meeting that owing to the large number of grid events in the region and the intervening period between two successive PSC meetings, a detailed discussion of such large events during the limited time frame of the meeting becomes difficult. Further, it has been observed that several events observed in the grid require immediate analysis and rectification of defects.

Considering the above, it was proposed that a Protection Analysis Sub-Group (PSAG) would be formed to discuss and analyse major grid events, which require immediate attention. In addition to discussion, the subgroup shall suggest specific corrective actions required by respective entity. The entities shall submit the status of compliance of these recommendations in a stipulated time frame.

PSC had decided to constitute a Protection Analysis Sub-Group (PSAG) with members from NRPC Secretariat, NRLDC and POWERGRID as permanent members. Further, all other utilities of Northern Region would provide one nomination each. The nominee from the utilities would be called when the tripping related to that utility is to be discussed. The group shall conduct its business on monthly basis and submit its report to PSC.

Members may provide the nomination from their organization for Protection Analysis Sub-Group

B. 1 Analysis of tripping since last PSC

A summarized status of the Grid Incidents/Disturbances occurred in Northern Region from Jan-June, 2016 was posted on nrpc website vide letter dated 18.11.2016. Members are requested to submit the detailed report alongwith the remedial measures suggested for these incidence/disturbances to NRPC Sectt. and NRLDC. Further, some of the critical tripping out of these will be discussed in this PSC meeting. Details of the tripping to be discussed in 32nd PSC will be uploaded on NRPC website sahortly.

Members may deliberate

Annex-I

Non- Availability/ Defective PLCC Link of STU Lines terminated at POWERGRID NR-2 substations

PLCC issues with J&K PDD				
S.No	**Name of Substation**	**Name of Line**	**Availability of PLCC**	**Status**
1	Wagoora	220 KV Zainakot-I	Not Available	POWERGRID is working. Likely to be completed progressively by 31.07.2016.
2		220 KV Zainakot-II	Not Available	
3	Kishenpur	220 kV Barn-I	Not Available	
4		220 kV Barn-II	Not Available	
5		220 kV Mirbazar	Pending for commissioning by PDD after LILO of 220 kV Kishenpur-pampore Ckts.	
6		220 kV Ramban		
PLCC issues with PSTCL				
01	Ludhiana	220kV Pakhowal	Installed but not working	As per PSTCL PLCC is working. End to end joint testing is completed for Ludhiana but pending for Amritsar. **PSTCL to carry out the joint testing for Amritsar within 15 days and sumit the report of the same to NRPC sectt.**
02	Amritsar	220kV Verpal -I	Not Installed	
03		220kV Khasa -II	Not Installed	
04		220kV Verpal- II	Installed but not working	
05		220kV Khasa-I	Installed but not working	

Annex-III

Summarized Status of pending rectification of Defects observed during BPA

S.No.	Utility	No. of sub-stations covered under BPA	Expected Completion	Remarks
1.	UPPTCL	21	November, 2016	UPPTCL informed that work at few stations is pending and expected completion in phased manner by November, 2016.
2.	UPRVUNL	4	November, 2016	Obra'A' – June, 2016 (including rectification of Time synchronization & BBP, PLCC (to be installed by UPPTCL). To be completed by November, 2016. Harduaganj– Completed.
3.	RRVPNL	8	October, 2016	Rectification of seven sub-stns completed. 400 kV Ratangarh S/s is expected to be completed by 31st October, 2016.
4.	HPSEB Ltd.	1	March, 2017	Out of 12 deficiencies observed, 8 items stand already rectified. The rectification of defects of remaining 4 No. items will be completed by March, 2017.Taken in PSDF scheme.
5.	UJVNL	1	December 2016	Breaker for 220 kV Khodri-I & II needs to be replaced. Expected date as intimated by SLDC uttrakhand in 127th OCC meeting is 31.12.2016
6.	PDD, J&K	3	Status of progress is not submitted. Target completion not known.	As informed during 33rd NRPC meeting that deficiencies where procurement was not involved had been rectified and other works where procurement is involved are yet to be taken up. PDD J&K informed that they have submitted the proposal for PSDF funding and deficiencies will be rectified when fund will be disbursed from PSDF. As informed by PSTCL defects at 220 kV Sarna-Udhampur line, pertains to PDD, J&K.
7.	NTPC	10	November, 2016	**Unchahar:** 30.11.2016(Completed)

Annex-IV

Protection audit of intra-state system / balance system not covered in Basic Protection Audit

Utility	Third party protection audit carried out by	No. of sub-stations covered/ expected to be covered	Status of Audit	Status of Report	Status of submission of action Plan for rectification of deficiencies
RRVPNL, RRVUNL	CPRI	RRVPNL-39 RRVUNL-5	Completed	Submitted	RRVPNL-Deficiencies rectified except that of related to batteries. RRVUNL- Action Plan submitted.
BBMB	-do-	20	-do-	Submitted	The action to attend the deficiencies observed in the audit is underway
PSTCL, PSPCL	-do-	PSTCL-22 PSPCL-3	-do-	submitted	Action Plan would be submitted.
UPRVUNL	-do-	2	-do-	submitted	Parichha TPS and Panki TPS: All the deficiencies are likely to be rectified by March.-2017.
UPPTCL	-do-	41	completed	Report by CPRI submitted.	Action Plan not submitted.
Rosa Power	-do-	1	Completed	Submitted	Action Plan submitted and the deficiencies observed rectified
UJVNL	-do-	2	Completed	Submitted	Action Plan not submitted.
PDD J&K	-do-	3	Completed	Submitted	Action Plan for Heeranagar and Amargarh not submitted.
JSW	-do-	1	Completed	Submitted	Rectification of observation complied.
HPSEB Ltd.,	-do-	6	Completed	Submitted	Action Plan for 4 sub-stations namely 220 kV Kotla not yet submitted. Rectification of observation partly complied. Rectification will be completed by March,17
UT Chandigarh	-do-	1	Completed	Submitted	Not submitted.
Budhil Power	-do-	1	Completed	Submitted	Not submitted.

Annex –V

Status of Bus bar Protection for Northern Region Constituents

State/Constituent	TRANSCO /GENCO	Total No. of S/S/Switchyards(220 kV and above)	No. of substations/ switchyards where Bus bar protection is functioning	Remarks	Action Plan
Delhi	DTL	37	34	For 220 kV s/stns namely , Gopalpur and Kanjhawala is being planned.(Lddi Road is GSS)	25 nos. new BBP is being procured. Under Approval Stage. Tender will be floated for 08 no. by 31.10.2015. **Tender to be opened by June, 2016 end. Expected commissioning by Dec., 2016.**
Haryana	HVPNL	61	32	17 nos. defective, for 07 nos date is yet to be decided and for 05 nos. of sub-stations it is not required. .	20 nos would be commissioned progressively by 31.12.2016
	HPGCL	03	03		
Rajasthan	RVPNL	95	23+(6defective)		80 nos under procurement.10 received commissioned by 31.12.2015
	RVUNL	05	05		
Himachal Pradesh	HPSEB	08	05	At one s/s it is working, 2 sub-station it is defective.	02 no will be commissioned by this year end and rest by March, 2016.
Punjab	PSTCL	90 (4 no 400 kV s/s)	45 (4 no 400 kV s/s)		For 07 nos. Commissioning is in progress, will be completed by December, 2016. For remaining tendering process underway.
	PSPCL	03	03		
J&K	PDD	06	-		**The status for the same could not be ascertained as representative from PDD, J&K was not present in the meeting.**
Uttarakhand	PTCUL	10	09		
	UJVNL	-	-		
BBMB	BBMB	23	20	Not required at Dhulkote and Jagadhari. also for Sangrur, Kurukshetra and Delhi as no. of feeders is less than five. PSC	**Sangrur-Commissioned on 19.01.2016.** For Barnala it is to be provided by PSTCL as agreed in PSC.PSTCL will commission it by 31.12.2016. **Kurukshetra and Delhi will**

				decided that it needs to be installed.	**be commissioned by 2018.**
Uttar Pradesh	UPPTCL	82	10	21 nos. received and commissioning is in progress, will be completed by June 2015f procurement stage.	For the remaining stationed procurement action has been initiated.
	UVUNL	05	-		
POWERGRID	PGCIL	55	55		
Central Generating Stations	NTPC	11	11		
	NHPC	09	09		
	NPCIL	02	02		
	THDC	02	02		
	SJVNL	02	02		

Annex-VI

Sl. No.	Event	Date & Time	Fault clearance	Incident	Analysis of the incident	Remedial action advised / taken
1	Multiple element tripping at 400/220kV Daultabad Station	01/05/2014 at 16:30 Hrs	~1000ms as per PMU	Blast in B-phase CT at 220kV Nuna-Mazra station and tripping of 400/220 kV 315MVA all 3 ICTs along with 400kV Daultabad-Gurgaon ckt2 & 400kV Daultabad-Jhajjar ckt1	HVPNL informed that on 01.05.2014 at 16:29:24 Hrs , the "R" Phase 220kV Current Transformer of 220kV Daulatabad-NunaMajra Ckt-1 bursted with heavy sound and splash of Oil & splinters of porcelain. Along with the damage of CT, 220kV Nunamajra Ckt-1 tripped off with Zone-1 Distance Protection (Main-1) within 19ms as per DPS event log. Main-2 distance protection also confirms Zone-1 tripping after 39ms. After an auto-recloser at 238ms, the CB comes under AR Lockout mode & isolated the faulty portion from 220kV Bus at 220kV Daulatabad. Simultaneously , the "B" phase jumper of 220kV Daulatabad-Nunamajra CKt-2 snapped out , hanged & touch with tower at Tower Location #4 (4th tower from substation) caused another B/G fault. Both DPR (Main-1 & Main-2) detected a PSB fault & blocked operation of relay till 152ms as per event log.Main-1 confirms AR Lockout @533ms & Main-2 @737ms. The E/F (Directional Backup) protection didn't operate with no reason. The operation of relay was recently tested by M&P team on 11.02.2014 found OK. The 220kV fault was fed by the 3No's ICTs operated in parallel to same bus and caused tripping of all ICTs on E/F (220kV Incomers) @503ms, 683ms & 699ms. As the GPS synchronization is not operated on 400kV substation & not installed on 220kV substation, the fault analysis up to minute level couldn't be done. The HV side CBs (Main+Tie) of all ICTs tripped along with 220kV Incomers due to inter-tripping. No relay observed on HV side of all ICTs. No 400kV Line affected/tripped during incident. The fault was also feed from 220kV Manesar & Badshahpur so caused tripping with backup protection at both substations.	Remedial Measures Adopted by Haryana: 1. Lowering of TMS settings of 220kV OG feeders from 0.19 to 0.15. 2. Provision of Numerical O/C+E/F (With Highset) on all 220kV Outgoing feeders for better analysis & fine settings. As discussed with SE/TS, Gurgaon, 4No's spare O/C+E/F (ER Make Numerical Relays) are being spared from 220kV sector-72 Gurgaon and will be erected on following feeders within 2 days. 220kV Daulatabad-Nunamajra-1 220kV Daulatabad-Nunamajra-2 220kV Daulatabad-Manesar-1 220kV Daulatabad-Manesar-2 3. Taking up the matter of non-operation of CSC101 relay with nearby fault & causing relay blocking on PSB. Being same length, settings of DPS relays (Main-1 CSC101, Main-2 CSC101) of 220kV Daulatabad-Nunamajra CKt-1 & 2 were same but the DPS scheme of CKt-1 operated well & DPS scheme of CKt- 2 didn't operate properly. (All 4 No's DPS relays of Nunamajra Ckt-1 & 2 (Main-1 & 2) were tested by M&P team on 12.03.2014 by PONOVO test kit & found OK. The settings of relays are being sent to ER for further analysis. PSC advised HVPNL to further clarify following points, in a fresh report: As per setting provided by Haryana, ICT's at Daultabad should have tripped in 1000ms as fault current was 4.8kA. Tripping of ICT at various durations (ICT-1 in 550ms; ICT-2&3 in 760ms) needs to be looked into. The E/F (Directional Backup) protection didn't operate. It needs to be looked into. Wiring of Digital data needs to be looked into. The failure of E/F (Directional Backup) protection
2	Multiple element tripping at 400kV Sarnath(UP)	14/04/2014 at 09:02 Hrs	~2000ms as per PMU	Complete failure of supply at 400kV sarnath Substation	A B-phase to ground fault took place on 400 kV Sarnath-Azamgarh line. At 400 kV S/S Azamgarh circuit breakers tripped but CB did not trip at 400 kV S/S Sarnath, as the line distance protection relays (SIPROTEC & RAZFE) did not operate. At Sarnath S/S, 400 kV Bus Bar protection is defective/out of service. This resulted in tripping of all the lines from remote ends except 400 kV Sarnath-Anpara (L-5) which tripped at Sarnath S/S. Thus complete supply failed at 400 kV Sarnath S/S".	PSC suggested following remedial Actions: At 400 kV Sarnath S/S, Bus Bar Protection be rectified and put back in service at the earliest. (Action UPPTCL). Carrier inter tripping scheme of 400 kV Sarnath-Azamgarh line be checked for correct operation under fault conditions (Action UPPTCL). 400 kV Sarnath-Anpara (L-5) line tripped at Sarnath S/S in the reverse direction. Line distance protection relay is to be checked and remedial action be taken (Action UPPTCL). 400 kV Anpara-Mau line tripped at Mau S/S for a 400 kV fault at Sarnath S/S. This needs further investigation (Action UPPTCL). Non-tripping of 400kV Azamgarh-Sarnath ckt from Sarnath end needs to be looked into. (Action UPPTCL) Carrier inter tripping scheme of 400 kV Sarnath-Azamgarh line needs to be reviewed. (Action UPPTCL) Tripping of 400kV Anpara-Mau line from Mau end on fault in 400kV Azamgarh-Sarnath line needs to be looked into. (Action UPPTCL) It is worthy to mention here that there is no Bus Bar protection scheme available at Sarnath S/S which is a requirement as per Grid standards for all substations of 220 kV and above level. (Action UPPTCL) Non-tripping of 400 kV Sarnath-Anpara (L-5) from Anpara end needs to be checked that's why this line later on tripped in reverse zone protection operation at Sarnath S/S. (Action UPPTCL) What was the status of ICTs at the time of tripping? ICTs also tripped or remained in operation? If ICT didn't trip than reason of non-tripping of ICT's needs to be relooked because fault persisted in the system for ~2000ms. (Action UPPTCL)
3	Multiple element tripping at 400/220kV Sarnath(UP)	05/05/2014 at 09:03 Hrs	(i) As per PMU data fault persisted in the system for ~320ms; (ii) As per NRLDC SoE data, Bus became open after 7.7 second of fault time	Tripping of 400/220kV, 315MVA ICT-I on Back up Earth fault and 240MVA ICT-II on overload causing 220kV & 132kV Bus dead."	While doing the maintenance work (on 220kV Sahupuri Bay) maintenance staff provided the T&P to other staff by tugging and throwing PVC rope which was deflected and intruded in the electrical clearance range of live part of 220kV transfer Bus tandem isolator of Sahupuri bay (The transfer Bus was in service since 04.05.2014 due to air leakage in 160 MVA 220/132kV ICT-II ABCB breaker). This resulted in immediate tripping of 400/220kV, 315MVA ICT-I on Back up Earth fault and 240MVA ICT-II on overload causing 220kV & 132kV Bus dead."	PSC recommended following actions: Over Flux alarm on 220kV side of 315MVA ICT-I & 400kV side of 240MVA ICT-II needs to be relooked. (Action: UPPTCL) Bus Bar protection scheme should be installed/ made functional at Sarnath S/S which is a requirement as per Grid standards for all substations of 220 kV and above level . (Action: UPPTCL)

4	Multiple element tripping at 220kV IA Hisar (HVPNL) sub-station	06/04/2014 at 17:43 Hrs	~460ms as per PMU data	Tripping of all elements at 200kV Hissar IA	There was fault in 132/11kV ICT at Hissar(IA) and blue-phase CT bursted. As bus bar protection at 220kV Hissar(IA) was not available that why all the elements at 220kV Hissar IA tripped	HVPNL was requested to clarify following: 1. Fault clearance time was ~460ms. Delayed clearance of fault needs to be looked into. 2. Non-availability of Bus Bar Protection at 220kV station level is clear violation of CEA Technical Standard for Construction of Electrical Plants and Electric Lines In the answer of above points HVPNL reported that (1) All the lines tripped from remote end in zone-II i.e. after 350ms time delay due to nonavailability of the bus bar protection. Matter under consideration of the Nigam. (2) The existing bus bar protection scheme (HBB make, Radha type) is very old/static and the wiring work etc. is incomplete; new numerical scheme to be provided. (3) All relays installed on 22/132kV 50MVA ICT-3 are electromechanical in nature and no extra DR/EL are installed on the panel. HVPNL was requested to submit a timeline of completion of corrective measures to NRPC sect. with a copy to NRLDC.
5	Complete Blackout at 220kV Harduaganj Station	09/04/2014 at 05:41 Hrs	~440ms as per PMU	Complete failure of supply at 220kV Harduaganj TPS	At Harduaganj switchyard, Y phase jumper between CT and Bus of 220 KV Harduaganj- Hathras (Radial) line broke. Bus Bar Protection has not been installed at Harduaganj TPS. The fault was isolated by tripping of all the 220 KV lines at Harduaganj TPS from remote ends in Zone – II. Generating unit nos. 8 & 9 which were on bar tripped on over current protection. Thus complete 220 KV supply failed at 220 KV Harduaganj TPS	PSC recommended following remedial Actions by UPRVUNL/UPPTCL:- At 220 KV Harduaganj TPS, Bus Bar Protection be installed and commissioned at the earliest. Protection at Harduaganj station needs to be thoroughly checked because complete 220kV Harduaganj station blackout occurred 4 times in last 1year. Delay in clearance of fault needs to be looked into. Tripping of 220kV Khurja- Harduaganj D/C before fault needs to be looked into. Max dip in R-phase shown in PMU although it was reported that fault was in Y-phase. It needs to be reviewed. Reason of tripping of unit-8&9 at Harduaganj station needs to be established. Protection at Harduaganj station needs to be thoroughly checked because complete 220kV Harduaganj station blackout occurred 4times in almost last 1year UPPTCL/ UPRVUNL were requested to submit the reply of the above mentioned point's within 15 days.
6	Multiple element tripping at 400kV G. Noida	12/04/2016 at 06:36 Hrs	~480ms as per PMU	Tripping of 400kV G.Noida-Dadri & G.Noida-Nawada ckt	Bus Bar Protection operated at 400kV G. Noida station. 400kV G. Noida-Dadri & G. Noida-Nawada ckt tripped. HVPNL informed that 400kV Nawada-G. Noida tripped on over current protection.	PSC recommended following remedial actions: Bus Bar protection operation at G. Noida station needs to be relooked. Exact location of fault needs to be established. (Action: UPPTCL) HVPNL may also inform about the status of other Bus at 400kV Nawada station, which was earlier unavailable due to problem of Bus CT. (Action: HVPNL) Over current protection needs to be disabled in all 400kV lines as per NRPC protection philosophy. (Action: HVPNL) UPPTCL and HVPNL were requested to submit the detailed report within 15 days.
7	Heavy Oscillation observed in Punjab area of NR System	16/04/2014 at 06:40 Hrs & 18/04/2014 at 15:43 Hrs	~350ms in Zone 2	Tripping of 220kV Nabha-Dhuri & 220kV Nabha-Faggan-Majra Ckt-1		Representative of Punjab informed that PSS has been tuned recently by the OEM
8	Multiple element tripping at 220kV Nabha station	29/04/2014 at 12:31 Hrs	~240ms as per PMU	Tripping of 220kV Balwan-Nabha ckt and 220kV Nabha-Faggan Majra(220kV Patiala) Ckt-1 in Zone-3 along with 220/66 kV T/F	With the damage of R- Phase CT & Breaker Limb at 220 kV s/s Nabha resulted into tripping 220kV Balwan-Nabha ckt and 220kV Nabha-Faggan Majra(220kV Patiala) Ckt-1 in Zone-3 along with 220/66 kV T/F. However during this incident all the other Ckts i.e. 220kV Balwan(400/220kV Dhuri)-Dhuri ckt 1&2, 220kV Balwan-Sunam Ckt 1& 2, 400kV Balwan-Rajpura ckt 1&2, 400kV Balwan-Talwandi circuit were in healthy condition. At 00.30hrs NPL Unit-1 of 700MW running on Ex-bus generation of 660MW generation was tripped by NPL due to fluctuation in generation	PSC recommended following: Tripping of unit at Rajpura needs to be relooked because oscillation was not observed in the system and fault also got clear in 240ms. (Action: NPL) Non-tripping of 220kV Nabha-Patiala ckt from nabha end needs to be reviewed. (Action: NPL) Non-operation of bus bar protection at Nabha station needs to be looked into. (Action: NPL) DR/ EL at 220kV Dhuri station to be time synchronized. (Action:PSTCL) RPC requested Punjab to submit the status of corrective measures & bus bar protection at 220kV Nabha Station.
9	Multiple element tripping at 132kV SEWA-2 station	29/04/2014 at 17:54 Hrs	~860ms as per PMU data	Y phase to ground fault occurred in 132kV Kathua-SEWA2 ckt and at the same time all 3 running unit of SEWA2 also tripped on GT over current stage-2	Representative of NHPC informed that protection at 220 kV Heeranagar station is not proper. SEWA-2 units have setting of backup over current/earth fault protection as definite time with 500-600ms time delay. PSC advised to temporarily change the zone-3 time delay setting as 450ms and regularly take up the issue with PDD J&K.	PSC recommended following: Delayed clearance of fault needs to be looked into as it is serious cause of concern. (Action: PDD J&K) As per SoE 132kV Sewa2-Heeranagar ckt-2 tripped. It needs to be reviewed. (Action: PDD J&K) As reported fault was in 132kV Kathua-Sewa2 ckt then tripping of the same line from Sewa2 in zone-3 needs to be looked into. (Action: NHPC) As per DR printout it seems 132kV Sewa2-Kathua ckt tripped in 250ms at 17:54:57.788hrs but as per PMU fault got clear at 17:54:58.720hrs, it means fault was existing in the system. This aspect needs to be examined. (Action: PDD J&K, NHPC) It seems SoE data of SEWA2 is not time synchronized. Immediate action should be taken for time synchronization. (Action: NHPC) Setting at units of SEWA2 needs to be looked into. (Action:NHPC)

10	Multiple element tripping at 220kV Station Samaypur(BBMB)	03/05/2014 at 17:38 Hrs	~400ms as per PMU data	Tripping of 220 KV Samaypur-Ballabgarh(BBMB) triple ckt 220 KV Samaypur-FGPP ckt-1 Unit #2 & #3 of BTPS(100MW each) 400/220kV ICT-2 220kV Bus Sectionaliser & Bus Coupler	While charging 220kV Samaypur-Ballabgarh ckt1 from Samaypur end after cancellation of PTW(Permission to work) Y-phase limb of wave trap got damage and at the same time multiple element tripping occurred at 220kV Samaypur station	
11	Complete blackout at 220kV Sarna Station	05/05/2014 at 09:49 Hrs	~680ms as per PMU data	Tripping of all 220kV lines from remote end except 220kV tibber ckt at 220kV Sarna Station	Y-phase CT of Bus coupler at Sarna station bursted, as bus bar protection at 220kV Sarna station was not available so it resulted into tripping of all 220kV lines from remote end except 220kV tibber ckt	PSC recommended following remedial actions: - Non-availability of Bus Bar Protection at 220kV Sarna station needs to be looked into. As it is clear violation of CEA Grid connectivity standards. (action: PSTCL) - SCADA data & SoE are not configured at 220kV Sarna station due to problem in RTU at Sarna Station. (Action: PSTCL) - In DR of SEWA-2 there is issue of RYB with ABC in configuration. This should be corrected immediately. (Action: NHPC) Representative of PSTCL informed that Bus Bar Protection at Sarna is being commissioned and same would be completed by 31st July, 2014.
12	Multiple element tripping at 400 kV Muradnagar(UP)	17/05/2014 at 21:31 Hrs	~1000ms as per PMU data	Tripping of all 3 ICTs at Muradnagar Station due to delayed clearance of fault on 220kV Muradnagar-Baraut line	It was concluded from information that fault was in reverse zone of 220kV Muradnagar-Baraut line. Due to delayed clearance of fault 400/220kV ICT-1&2 tripped on directional earth fault & 400/220kV ICT-3 tripped on directional over current protection. As 220kV Sahibabad was not radial but was connected to the grid on that day, it tripped from Sahibabad end. 400kV Dadri-Muradnagar line tripped from Muradnagar end in reverse zone protection. The last one was a wrong operation. 2. PLCC communication in 400kV Dadri-Muradnagar line at Muradnagar end is okay and signal was received at Dadri end but there was problem in the relay (in zone-3 blocking) at Dadri end and same was rectified by NTPC. 3. Tripping of 220kV Sahibabad-Muradnagar ckt-1 on R-phase to ground fault in zone-1 needs to be relooked. It might have been due to sensitive setting of distance protection zone-1 at Sahibabad end 4. LBB Protection & Bus Bar Protection at 220kV Muradnagar is yet to be installed. 5. 400/220kV ICT's have electro-mechanical relay instead of numerical relay. 6. Preliminary Report, Flag details & Detailed report has been received from UP in the meeting. It was reported in detailed report that printout of DR/EL details is not available.	1. LBB protection & Bus Bar protection at 220kV Muradnagar to be installed at the earliest possible. (Action: UPPTCL; Time Frame: 6 month) 2. Electromechanical relay of ICT's to be replaced by Numerical relay. (Action: UPPTCL; Time Frame: 3 month) 3. Status of breaker at Baraut end of 220kV Baraut-Muradnagar line to be checked. (Action: UPPTCL; Time Frame: 7 days) 4. Sensitive setting of distance protection zone-1 at Sahibabad end of 220kV Sahibabad-Muradnagar ckt-1 to be reviewed. (Action: UPPTCL; Time Frame: 7 days) 5. Downloading Software for extraction of DR/EL to be ensured. (Action: UPPTCL; Time Frame: 1 month) SE(O), NRPC stated that many tripping had occurred in Muradnagar Station. UP was requested kindly looked into the matter and take necessary action for proper protection operation & Co-ordination at the station. UPPTCL was also requested to submit action taken on aforesaid recommendations in next PSC meeting.
13	Multiple element tripping at 400 kV Sonepat(PG)	23/05/2014 at 16:18 Hrs	~1320ms as per PMU data	Tripping of Sonepat-Mohana ckt-1 & 2 and all 2 ICT's at 400/220kV Sonepat Station	Y-B phase to phase fault occurred in 220kV Mohana-Samlakha ckt. Mohana end relays did not operate and fault was not cleared. Due to delayed clearance of fault 220kV Sonepat-Mohana ckt-1 & 2 and all 2 ICT's at 400/220kV Sonepat station also tripped.	Recommendations of Protection sub-Committee: 1. Main & Backup protection system at 220kV Mohana station to be checked & corrected by HVPNL. (Action: HVPNL; Time Frame: 15days) 2. Tripping of 220kV Sonepat-Mohana ckt2 from Mohana end needs to be explained by HVPNL. (Action: HVPNL; Time Frame: 15days) 3. PLCC communication should be made healthy in 220kV Mohana-Samlakha D/C. (Action: HVPNL; Time Frame: 15days) 4. Backup protection of 220kV Sonepat-Samlakha ckt at Sonepat end needs to be ensured by POWERGRID. (Action: POWERGRID; Time Frame: 15days)

14	Multiple element tripping at 400 kV Parichha (UP)	29/05/2014 at 13:19 Hrs	~4000ms as per PMU data	Tripping of 220 KV Parichha-Orai-III line at Orai S/S and tripping of Parichha Unit Nos. III, IV, V & VI due to loss/tripping of 6.6 kV station supply on account of low voltage and tripping of 220kV Parichha-Banda line at parichha S/S on LBB Protection	R-phase fault took place on 220 kV Parichha-Orai-I line. At Orai S/S, circuit breaker tripped but at Parichha TPS, distance protection relay did not operate. At Parichha TPS, 220 KV Bus Bar Protection was out of service. This resulted in tripping of 220 KV Parichha-Orai-III line at Orai S/S and tripping of Parichha Unit Nos. III, IV, V & VI due to loss/tripping of 6.6 kV station supply on account of low voltage. 220 kV Parichha-Banda line tripped at Parichha S/S on L.B.B. protection.	Recommendations of Protection sub-Committee - 1. At Parichha TPS, distance protection relay of 220 KV Parichha-Orai-I line be attended and set right for correct tripping under fault conditions (Action: Parichha TPS, UPRVUNL, Time frame: One Month). 2. At Parichha TPS, 220 KV Bus Bar protection be put back in service at the earliest (Action Parichha TPS, UPRVUNL, Time frame: 03 months). 3. At Parichha TPS, tripping of 220 KV Parichha-Banda line for a fault in the reverse direction, be investigated and set right (Action Parichha TPS, UPRVUNL, Time frame: Immediate). 4. Non-tripping of 220 KV Parichha-Bhartana line needs further investigation (Action Parichha TPS, UPRVUNL/UPPTCL, Time frame: Immediate). 5. At Parichha TPS, it has been observed several times in the past, that delayed/nonclearance of line faults from Parichha TPS end has resulted in complete tripping of all the generating units and lines. It seems that protection system of the transmission lines is not effective at Parichha end. Therefore, at parichha TPS, the polarity of all the instrument transformers and their star points be checked and setting and periodical testing of all the line protections be ensured so as to avoid tripping of generating units. (Action Parichha TPS, UPRVUNL, Time frame: 15 days). 6. Software for downloading the DR/EL to be ensured (Action: Parichha TPS, UPRVUNL & UPPTCL, Time frame: 03 months)
15	Multiple element tripping at 400 kV Chhabra TPS (Rajasthan)	05/06/2014 at 13:10 Hrs	~560ms as per PMU data	Tripping of 400KV CTPP-Bhilwara feeder	400KV CTPP-Bhilwara feeder tripped at 13.10:24:646hrs on dated 05.06.2014 with fault indication zone-2 R-Phase distance 346 km. On inquiring from 400kV Bhilwara, it emerged that 220kV feeder fault was reflected in this line. The relay setting for zone-2 at 400kV Chhabra end is 120% of total distance with time delay 300ms. The feeder from remote end (Bhilwara end) tripped on DT received on account of overvoltage, as the fault in their end in reverse zone. Protection sub-Committee Conclusion - 1. Fault was in LV side of the feeder. Flashover observed in the cable. 220kV lines from Bhilwara and remote end also tripped during the incident. 2. Zone-2 tripping of Chhabra end distance relay at fault location of 345km is wrong operation and same to be looked into by RRVUNL/RVPNL. Time delay for zone-2 at Chhabra end is 300ms 3. Reason of delayed clearance of fault needs detailed investigation at Rajasthan end. 4. Reported reason of tripping of unit at Chhabra on over voltage protection needs to be analysed and corrected. The actual reason may be over frequency, as generation was higher than load in the island. 5. If one unit is under shut-down than tie CB of that unit should be under charged condition to enhance reliability of the station. Both the buses should be coupled with maximum number of tie CB available at the sub-station. As in this tripping also both the buses at Chhabra end were decoupled resulted into tripping of all the running unit at Chhabra. Otherwise one unit at Chhabra might have survived. 6. DR of Chhabra end & relay at Bhilwara end were not time synchronized. 7. DR details of 220kV level station of Bhilwara and remote end were not available. 8. Rajasthan should make sure availability of the Digital SCADA data to the NRLDC. 9. Dia of the unit-3 & 4 should be closed at the earliest possible for better operational practice.	1. Dia of the unit-3 & 4 should be closed at the earliest possible for better operational practice (Action: RRVUNL; Time Frame: Immediately) 2. RRVUNL kindly submit the status of implementation of SPS for units at Chhabra in case of tripping of any outgoing line (all the running units except one to be tripped) (Action: RRVUNL; Time Frame: Immediately) 3. Detailed analysis report along with remedial action report from Rajasthan to be submitted (Action: RVPNL; Time Frame: 7days) 4. Availability of DR at 220kV level and above needs to be ensured by Rajasthan. 5. Time synchronization of DR of Chhabra end to be corrected. (Action: RRVUNL; Time Frame: 7days) 6. Time synchronization of relay at Bhilwara end to be corrected. (Action: RVPNL; Time Frame: 7days) It was requested to the utilities to submit .dat & .cfg file for proper analysis.
16	Complete station outage of 400 kV Khedar TPS(Haryana)	05/06/2014 at 00:03 Hrs	~360ms as per PMU data (fault clearance time for first two incident was within 80ms but for third incident time was 360ms)	Complete outage of the 400kV Khedar generating station.		No executive from HPGCL attended the meeting. So event was not discussed in the meeting.

17	Multiple element tripping at 400 kV Moradabad(UP)	06/06/2014 at 11:50 Hrs	~2440ms as per PMU data	Complete failure of 220kV supply at Moradabad S/S	At 400kV Moradabad Sub-station, Y-phase to ground fault took place on 220kV Moradabad-CB Ganj line. At CB Ganj S/S, circuit breaker tripped but at Moradabad S/S distance protection relay and backup protection did not operate. The fault was finally isolated by tripping of all the remaining two nos. lines at remote ends and tripping of 2*315 MVA ICT-I & II from H.V. side. Representative from UPPTCL informed the details of the tripping as below- 1. CPU card of the relay of 220kV Moradabad- CB Ganj was found defective and it resulted into failure of main (distance protection) and backup protection (earth fault protection). Defective CPU card has been replaced and now main and backup protection is fully functional. 2. PLCC communication in 220kV Moradabad-CB Ganj ckt would be commissioned within 15days 3. Delayed clearance of fault was due to failure of main & backup protection at Moradabad station	Recommendations Protection sub-Committee - 1. At Moradabad S/S, the 220 KV Bus Bar Protection to be commissioned and put in service at the earliest. (Action UPPTCL, Time Frame: 30 days) 2. Downloading Software for extraction of DR/EL to be ensured. (Action: UPPTCL, Time Frame: 1 month)
18	Multiple element tripping at 400 kV Daultabad (Haryana)	07/06/2014 at 15:37 Hrs	~400ms as per PMU data (As per PMU Data fault clearance time for first & last incident was within 80ms but for third incident(intermediate) time was 360ms	Tripping of ICT at Daultabad station	As per PMU data at 15:37:16.360hrs voltage dip in R & Y-phase was observed, which lasted for 80ms. At 15:37:55.760hrs Voltage dip in Y-phase was observed and lasted for 400ms. At 7:58.800hrs Voltage dip in R-phase was observed, which lasted for 80ms. But as per field report received from Haryana, it was mentioned that there wasno fault in the system and during the incident one ICT tripped on PRV operation and remaining one ICT tripped on overcurrent protection. Representative from UPPTCL opined that micro switch of PRV which make contact of PRV might have mal-operated.	Protection sub-Committee recommendations- 1. Availability & extraction software of DR/EL to be ensured. (Action: HVPNL; Time Frame: 15days) 2. Wiring of digital data needs to be ensured. (Action: HVPNL; Time Frame: 15days) 3. Haryana may find out the exact reason of operation of PRV so that it could be avoided in future. In case of mal-operation of micro-switch is found than same should be changed immediately. (Action: HVPNL; Time Frame: 15days)
19	Multiple element tripping at 400 kV Karcham Wangtoo(JPVL)	11/06/2014 at 16:52 Hrs	~1320ms as per PMU data	Tripping of Karcham to Abdullapur ckt-2 and 400kV karcham-Baspa ckt 1 & 2	At 16:52hrs of 11th June 2014, Y-phase to earth fault occurred in 400kV Karcham to Abdullapur ckt-2, at the same time 400kV Karcham-Baspa ckt 1 & 2 also tripped from Baspa end in zone-2. 400kV Karcham to Abdullapur ckt-2 line auto reclosed and finally tripped due to persistence of fault. At 17:14hrs, during charging of 400kV Karcham-Abdullapur ckt-2, this line tripped on SOTF and 400kV Karcham-Baspa ckt 1 & 2 also tripped from Baspa end in zone-2.	No representative from JPVL attended the meeting. However POWERGRID informed that there was some problem of line isolator in GIS at Karcham Wangtoo end. SE(O), NRPC requested JPVL to attend the meeting in future and to submit the detailed report of the incident within 15days
20	Multiple element tripping at 765/400 kV Unnao(UP)	12/06/2014 at 17:51 Hrs	~200ms as per PMU data	Tripping of 400 kV unnao - Bareilly -II line, 400kV Unnao-Panki line, ICT-1 & ICT-II at Unnao S/S	Repeated R phase to earth fault occurred on 400kV Unnao-Bareilly line II. On first occurrence, the line auto-reclosed from both ends while on next fault, line finally tripped as the fault recurred within reclaim time. However, on both incidents, the line tripped with a time delay of approximately 150ms due to non-receipt of permissive trip command from Bareilly end (tripping occurred in Z1B instead of Zone-1. At Unnao S/S, Main II relay (REL670) of Bareilly-II line is defective. Also, R-Phase jumper of FSC main bypass switch got damaged in the incident. Simultaneously, 765/400 KV, 1000 MVA ICT-I & II at Unnao also tripped on Breaker over current protection	Recommendations of Protection sub-Committee - 1. Setting of overcurrent (high set) protection should be revised. (Action: UPPTCL; Time Frame: 7days) 2. UP has reported loss of load but PMU data is showing dip in frequency. This aspect needs to be studied. (Action: UPPTCL, Time Frame: 07 days)
21	Multiple element tripping at 400 kV Uri-I HEP	16/06/2014 at 12:22 Hrs	~640ms as per PMU data	Tripping of 400kV Uri-I (NHPC)-Wagoora(PG) D/C & All 4 units (120MW each) of Uri-I(NHPC)	R-phase to ground fault occurred in 400kV Uri II (NHPC)-Uri I (NHPC) ckt. Due to delayed opening of breaker at Uri-I end, LBB protection operated at Uri-I end and sent the command to Bus Bar protection of Bus-II. 400kV Uri-I (NHPC)-Wagoora(PG) D/C & All 4 units (120MW each) of Uri-I(NHPC) tripped because all these ckt connected to Bus-2 only	Recommendation of Protection sub-Committee - 1. Elements should be segregated for connection to different buses instead of single bus. It should be taken care by all other entities (General Recommendation for all the entities) 2. Availability of digital & analog data at NRLDC needs to be ensured by NHPC. (Action: NHPC/POWERGRID; Time Frame: 7days) 3. Availability of PLCC link & auto recloser in 400kV Uri-I to Uri-II line to be ensured by NHPC/ POWERGRID (Action: NHPC/POWERGRID; Time Frame: 30days)

22	Complete blackout at 400 kV Parichha	19/06/2014 at 10:42 Hrs	~1880ms as per PMU data	Complete blackout at 400 kV Parichha	In antecedent condition, unit-1 & 2 of Parichha TPS & 400kV Paricha-Mainpuri(PG) D/C were already under shutdown. At Parichha TPS, 220kV Bus-Bar Protection was out of service. A fault was created in the switchyard of Parichha TPS due to snapping of 132kV, Y & B-phase jumper of CT of 132kV Mauranipur feeder. At Parichha TPS, Line distance protection relay of 132kV Mauranipur feeders was defective. Therefore, Backup directional E/F earth fault relay operated and circuit breaker tripped delayed. The fault was reflected on 220kV bus. This resulted in tripping of 220/132kV, 100 MVA transformer but 220/132kV, 160MVA transformer, 132kV side circuit breaker tripped delayed and 220kV side circuit breaker did not trip. Thus the fault was reflected on 220kV bus at Parichha, which resulted in tripping of 400/220 KV, 315 MVA ICT-I & II. Due to loss of 6.6kV station supply, Parichha Generating Unit nos. 3, 4, 5 & 6 tripped. Also, 220kV Orai-I, II & III, Banda & Bhartana lines tripped at Parichha.	Remedial Action to be Taken- 1. At Parichha TPS, Line distance protection relay of 132kV Mauranipur line be attended and put in service. (Action: Parichha TPS, UPRVUNL; Time Frame: 15days) 2. At Parichha TPS, 220 KV Bus Bar protection to be put in service at the earliest. (Action: Parichha TPS, UPRVUNL; Time Frame: 15days) 3. At Parichha TPS, protection scheme of 220/132 KV, 160 MVA ICT be checked and attended to ensure correct tripping of the ICT during fault conditions. (Action: Parichha TPS, UPRVUNL; Time Frame:15days) 4. Backup earth fault protection also needs to be looked into. (Action: Parichha TPS, UPRVUNL; Time Frame:15days) 5. At Parichha TPS, it has been observed several times in the past, that delayed/nonclearance of line faults from Parichha TPS end has resulted in complete tripping of all the generating units and lines at 400/220kV Parichha TPS. It seems that protection system of the transmission lines is not effective at Parichha end. Therefore, at Parichha TPS, the polarity of all the instrument transformers and their star points be checked and setting and periodical testing of all the line protections be ensured so as to avoid tripping of generating units. (Action: Parichha TPS, UPRVUNL; Time Frame: 30days) 6. Availability of DR/EL needs to be ensured at parichha TPS. (Action: Parichha TPS, UPRVUNL; Time Frame: 15days)
23	Multiple element tripping at 400 kV Tehri (THDC)	22/06/2014 at 13:36 Hrs	~160ms as per PMU data	Manual tripping of unit 2 & 4 of THDC	As per information received from Koteshwar pool (O&M) team, the shifting of 11kV line was done by some villagers without any supervision by state Discom. They cut the pole and the pole fell down resulting in overshooting of 11kV line thus the clearance was decreased and 11kV line come in near contact with 400kV Koteshwar pool(PG)- Tehri D/C. As per telephonic conversation with Tehri (THDC), Unit#2&4 continued to run in isolated mode after tripping of 400kV Koteshwar pool (PG)-Tehri D/C from both ends. Unit went into spinning mode operation. No Unit protection was operated and finally unit #2&4 was tripped by manual operation Protection sub-Committee Conclusion: 1. R-phase to ground fault occurred in 400kV Tehri-Koteshwar(Pooling) D/C due to shifting of underneath 11kV line. 2. As per DR details, it was observed that Y&B phase CB's of 400kV Koteshwar pool(PG)-Tehri ckt-1 also opened after 122ms, while fault was in only R-phase. 3. 400kV Koteshwar (Pooling)-Tehri ckt2 auto reclosed in 1300ms instead of 1000ms. 4. Preliminary Report, DR/EL have been received from POWERGRID/ THDC.	Remedial Action to be taken by POWERGRID- 1. Opening of Y&B phase CB's of 400kV Koteshwar pool (PG)-Tehri ckt-1 on single phase (R-phase to ground fault) fault needs to be checked. (Action: POWERGRID; Time Frame: 7days) 2. Delayed opening of Y&B-phase breaker by 122ms from R-phase needs to be corrected. (Action: POWERGRID; Time Frame: 7days) 3. Delayed auto reclosing of 400kV Koteshwar (Pooling)-Tehri ckt2 needs to be looked into. (Action: POWERGRID; Time Frame: 7days) SE(O), NRPC requested POWERGRID to submit the detailed report of the event within 5days to RPC/ RLDC.
24	Multiple element tripping in Delhi (due to Tower Collapse)	02/07/2014 at 14:03 Hrs	~800ms as per PMU data	Multiple element tripping in Delhi (due to Tower Collapse)	The tripping of 220kV Wazirabad-Geeta Colony Ckt-I& II at Wazirabad & Geeta Colony caused the islanding of generating units at RPH, Pragati (Unit I & STG) & GT running units. The island survived for a while but collapsed due to the tripping of Pragati G.T. It was further reported that the portion about 8 feet high above the chimney portion of the towers of 220kV Wazirabad-Kashmiri Gate Ckt-I&II collapsed and rested on 220kV Wazirabad-Geeta Colony Ckt–II which runs alongside the ckts, causing the damage of two spans of conductors of 220kV Wazirabad-Geeta Colony Ckt-II.	Protection sub-Committee Conclusion & Recommendation: 1. Delayed clearance of fault was due to failure of distance protection in 220kV SOWKashmiri Gate Line1. Same was replaced through new distance protection. 2. DTL to look into operation of UFR & df/dt in the island. It is a good case for find out issues in actual UFR & df/dt operation for upcoming Delhi islanding scheme.
25	Multiple Element tripping at 400kV Anpara-B TPS	10/08/2014 at 10:02 Hrs	~120ms as per PMU data	Tripping of generating unit no.4, 400kV Anpara-B TPS Bus Coupler, 400kV Anpara-B TPS Bus Section-I and 400kV Anpara-Sarnath line (L-5).	At Anpara TPS generating unit no-4 was running at about 370 MW with all the parameters normal. Load was low on account of poor and wet coal. At 10:02 hrs, 400kV Bus-Bar differential Protection of Anpara-B TPS Bus-I operated which resulted in tripping of generating unit no.4, 400kV Anpara-B TPS Bus Coupler, 400kV Anpara-B TPS Bus Section-I and 400kV Anpara-Sarnath line (L-5). On investigation, it was found that R-phase unit of generator transformer of unit no. 4 was damaged.	1. Bus Bar Protection at Anpara-B TPS needs to be checked & corrected. (Action: UPRVUNL; Time Frame: 15 days) 2. Timing of LBB protection (100ms instead of 200ms) & operation of LBB protection at Anpara-B TPS needs to be checked & corrected. (Action: UPRVUNL; Time Frame: 15 days) 3. GT protection operation needs to be looked into. (Action: UPRVUNL; Time Frame: 15 days) 4. Availability of digital signal also needs to be ensured. (Action: UPRVUNL; Time Frame: 15 days) 5. UPRVUNL representative(s) should attend the meeting in future so that event could be discussed properly. SLDC-UP may write a letter to UPRVUNL for attending the PSC meeting in future.They should also send the remedial action report of the incident within 15 days. 6. Software for extraction of DR/EL to be made available at each sub-station. (Action: UPPTCL, Time Frame: 1 month)

26	Multiple Element tripping at Agra(UP)	i) 8/08/2014 at 13:34 Hrs; iii)18/09/2014 at 17:56 Hrs	i) ~400ms; iii) 2200ms	i) Tripping of 400 KV Agra (UP)-Agra (PG) D/C 400/220 KV, 315 MVA-I at Agra 400/220 KV, 315 MVA-II at Agra 400/220 KV, 500 MVA at Agra 400 KV Agra-Unnao line 400 KV Agra-Muradnagar line 220 KV Agra-Gokul 220 KV Agra-Hathras 220 KV Agra-Shamsabad 220 KV Agra-Sikandra D/C 220 KV ikandra-Bharatpur 220kV Sikandra-Auraiya D/C ii)Tripping of 400/220kV 315MVA ICT-1&3 400/22-kV 500MVA ICT	Report is available on the NRPC website	UPPTCL and NTPC may submit the action taken on the recommendation suggested by the group
27	Multiple element tripping at 400kV Kashipur HEP	20/08/2014 at 13:41 Hrs	~1000ms as per PMU data	Tripping of 400kV Kashipur-Rishikesh line along with Kashipur-Moradabad line	Phase to phase fault occurred in 400kV Kashipur-Rishikesh line. 400kV Kashipur-Rishikesh line along with Kashipur-Moradabad line tripped.	1. Distance Protection of Kashipur end & Moradbad to be checked & corrected. (Action: PTCUL; Time Frame: 15 days) 2. Detailed Report from Uttrakhand to be submitted within 15days 3. Availability of digital data to be ensured. (Action: PTCUL; Time Frame: 15days)
28	Multiple Element tripping at 220kV Samaypur station	27/08/2014 at 23:22 Hrs	~660ms as per PMU data	Tripping of all the elements connected to Bus-I of 220kV samaypur station, all the feeders except charkhi dadri end of 220kV Samaypur-Charkhi Dadri ckt & 220kV Samaypur-Ballabgarh ckt-3	PSC Conclusions: 1. Y-phase CT of 220kV Samaypur-Charkhi Dadri line at 220kV Samaypur station burst & caught fire. It resulted into operation of Bus Bar Protection for Bus-I and all the elements connected to Bus-I of 220kV Samaypur station tripped. 2. Operation of Bus Bar Protection was correct operation but fault clearance time of 660ms needs more clarity.	PSC Recommendations: 1. Tripping of 220kV Ballabgarh-Samaypur ckt-3 was observed in SoE but same was not connected at Bus-1 and also not reported by BBMB. BBMB may investigate this aspect and report. (Action: BBMB; Time Frame: 15days) 2. Delayed Clearance of fault needs to be looked into and rectified. (Action: BBMB; Time Frame: 15 days) 3. Delayed clearance of fault from Charkhi Dadri end needs to be looked into and rectified. (Action: BBMB; Time Frame: 15days)
29	Tripping of 220kV Auraiya-Malanpur & Auraiya-Mehgaon ckt	28/08/2014 at 01:37 Hrs	~6000ms as per PMU data	Tripping of 220kV Auraiya-Malanpur & 220kV Auraiya-Mehgaon Line	PSC Conclusion: 1. It was concluded from the discussion that fault was in R-phase of Auraiya-Malanpur line. Line tripped from Auraiya end but due to non-opening of breaker at Malanpur end, fault was continuously fed through 220 kV Auraiya-Mehgaon lien & this line tripped from Auraiya end on back earth fault protection. 2. Delayed fault clearance at inter-regional boundary is a serious threat to the grid security. 3. The protection coordination observed during the tripping is not adequate which is observed with fault clearance time exceeding 6 seconds. 4. Fault clearance time was ~6000ms. Load loss was in Western Region. 5. Auto-recloser in 220kV Auraiya-Malanpur & Auraiya-Mehgaon line was not operational. 6. DR timing of Auraiya end of 220kV Auraiya-Malanpur & Auraiya-Mehgaon line was not time synchronized. 7. NTPC to make sure availability of the digital SCADA data to the NRLDC.	Protection Committee Recommendations- 1. Availability of digital data to NRLDC needs to be ensured by NTPC (Action: NTPC; Time Frame: 7 days) 2. Time synchronization of DR of 220kV Auraiya-Malanpur & Auraiya-Mehgaon line to be checked & corrected (Action: NTPC; Time Frame: 7 days) 3. Auto-recloser in 220kV Auraiya-Malanpur & Auraiya-Mehgaon line to be checked & corrected. NTPC may also furnish the outcome of the joint meeting with MPPCL. (Action: NTPC, MPPTCL; Time Frame: 7days) 4. Protection coordination needs to be checked & corrected. (Action: NTPC, MPPTCL; Time Frame: 7 days)
30	Multiple Element tripping at Unnao station	16/09/2014 at 05:03 Hrs	~200ms as per PMU data	Tripping of multiple element at Unnao S/S	An R-phase to earth fault took place on 400kV Unnao-Panki line. At Panki S/S circuit breaker tripped but at Unnao S/S, circuit breaker auto reclosed (with time taken upto 150 msec. due to non-receipt of carrier signal). Due to this, at Unnao S/S, 1000 MVA ICT-I & II tripped from 400kV side on overcurrent & earth fault protection. Delayed tripping of Panki line caused operation of 2nd stage E/F relay (In>2) configured in CB overcurrent and earth fault relays (50/51N) provided on 400kV side of 1000 MVA ICTs. This resulted tripping of both 765/400kV ICTs from 400kV side 400kV Unnao-Agra line tripped from Agra end in zone-1. All 3-phase of the Agra end of 400kV Agra-Unnao line & Panki end of 400kV Panki- Unnao line finally tripped due to PD (Pole Discrepancy) operation in Y&B phase of the line	PSC Recommendations: 1. Complete Protection review is required at 765/400kV Unnao stations. (Action: UPPTCL; Time Frame: 30 days) 2. Stage-2 setting of earth fault/over current protection of 1000MVA ICT's at Unnao station to be corrected. (Action: UPPTCL; Time Frame: 15 days) 3. Carrier inter-tripping scheme in 400kV Unnao-Panki line to be checked. (Action: UPPTCL; Time Frame: 15 days) 4. Distance protection setting of 400kV Agra-Unnao line to be checked & corrected. (Action: UPPTCL; Time Frame: 15 days) 5. At 400 KV S/S Panki and Agra, the reason of CB pole discrepancy should be checked and remedial action be taken. (Action: UPPTCL; Time Frame: 15days) 6. Availability of software for extraction of DR/EL to be ensured. (Action: UPPTCL; Time Frame: 1 month)

31	Multiple Element tripping at 400kV Daultabad station	19/09/2014 at 12:29 Hrs	~400ms as per PMU data	Multiple Element tripping at 400kV Daultabad station	During replacement of CT of Jharli ckt-1 at Daultabad station. Crane came into induction zone of the bay, it converted into bus fault for Bus-1 at Daultabad station.	PSC Recommendations: 1. Haryana should investigate the issues like non-operation of Bus Bar Protection, Sending of carrier signal from Gurgaon end and submit point wise reply to all the points raised by PSC. (Action: Haryana; Time Frame: 15 days) 2. The Bus Bar Scheme at Daulatabad to be reviewed with following recommendations: a. Practice of sending DT at remote end may be discontinued (in case of line charged via both main & tie CB) as for 1½Breaker Scheme all the feeders are to be remained charged through the Tie CBs. b. The tripping of Tie CBs may not be included in case of Bus Bar protection operation as it may not render the tripped Bus feeders charged. c. When tie CB is under off condition then DT would be sent to remote end of that breaker.(Action: HVPNL; Time Frame: 15 days)
32	Multiple Element tripping at 400kV Rampur HEP station	20/09/2014 at 14:15 Hrs	~100ms as per PMU data	Tripping of 400kV Jhakri-Rampur ckt-1 & tripping of unit -1, 4 & 5 of Rampur HEP	Jhakri-Rampur ckt-1 tripped on R-phase to earth fault. At the same time running unit -2, 4 & 5 of Rampur HEP also tripped.	PSC Recommendations: 1. Reasons for tripping of running generation units at Rampur HEP needs to be investigated and reportd. (Action: SJVN Ltd; Time Frame: days) 2. Time synchronization of the digital data to be ensured (Action: SJVN Ltd; Time Frame: 15 days) 3. Oscillations in Karcham HEP frequency to be investigated (Action: JVL, Time frame: 1 month) 4. Preliminary report, DR/EL & detailed report was awaited from SJVN Ltd. The report should be submitted on priority. (Action: SJVN Ltd; Time Frame: 7 days)
33	Multiple Element tripping at Dadri TPS	23/09/2014 at 08:46 Hrs	~200ms as per PMU data	Tripping of 400kV Dadri-Mandola Ckt-II on R-Y phase to phase fault	PSC Conclusions: 1. R-Y phase to phase fault occurred in 400kV Dadri-Mandola line. Line have POR scheme due to availability of FSC in 400kV Panki-Muradnagar line(390kM) with 40% compensation. 2. GT (Gas Turbine) at Dadri station tripped on “backup impedance protection short time”. ST (Steam Turbine) tripped due to tripping of GT. 3. "IMPEDANCE PROTECTION SHORT TIME" setting has been revised from existing 100ms to 600ms.	PSC Recommendations: 1. Time delay at Mandola and Dadrri end to be same(100 msec.) because of FSC compensation in 400kV Panki-Muradnagar line. (Action: POWERGRID, NTPC; Time Frame: 7 days) 2. Reason of tripping of ST within 350ms of tripping of GT needs to be investigated and corrective action be taken. (Action: NTPC; Time Frame: 15days)
34	Multiple Element tripping at 220kV Nuna majra station	24/09/2014 at 20:26 Hrs	~480ms as per PMU data	Tripping of 220kV Nunamajra-Rohtak D/C, 220kV Bahadurgarh(PG)-Nunamajra(HVPNL) D/C, 220kV Daultabad(HVPNL)-Nunamajra(HVPNL) D/C due to R-phase to earth fault at Bus of 220kV Nunamajra S/s	PSC Conclusions: 1. There was a Bus fault at 220kV Nuna majra station. Due to unavailability of bus bar protection at 220kV Nuna majra station, all the lines tripped from remote end in zone-2 timing. It resulted into delayed clearance of fault. 2. Sequence of event coudn’t be finalised due to unavailability of EL or numerical relays. 3. In case of unavailability of Bus Bar scheme at Nuna majra, scheme suggested by RVPNL (as discussed in previous event) should be opted by station so that elements connected to other bus wouldn’t trip. 4. Preliminary Report, Detailed report and DR/EL from Haryana yet to be received. 5. There is continuous violation the IEGC clause 5.2.r & CEA Grid Standard 5.3 as Detailed report, DR/EL were not being received from HVPNL in past also. 6. Every station should have submitted the DR/EL, Preliminary report to RPC/RLDC within 24hrs. Sub-station/power station incharge should be advised to furnish the details of tripping to RPC/RLDC within 24hrs.	PSC Recommendations: 1. In case of unavailability of Bus Bar scheme at Nuna majra, scheme suggested by RVPNL and agreed in the 25th PSC meeting should be opted by station so that elements connected to other bus wouldn’t trip. (Action: HVPNL; Time Frame: 7 days) 2. Haryana should submit the detailed report of the event. (Time Frame: 7days) 3. Bus Bar Protection to be installed at 220kV Nuna majra station. (Action: HVPNL; Time Frame: 3 months) 4. Numerical relay to be installed at 220kV Nuna majra station. (Action: HVPNL; Time Frame: 3 months)

35	Multiple element tripping at 220kV Obra TPS	24/09/2014 at 12:50 Hrs	~6160ms as per PMU data	Tripping of multiple element at 220kV Obra TPS	It has been reported by UPRVUNL site that analysing the flags/protection appeared/operated at different 220kV elements at ATPS, Obra end and 132kV Obra Hydel Switchyard, it appears that earth fault occurred at 132kV system and it was sensed by Obra Hydel units. It was cleared by 220kV Breaker of ICT-Ist & ICT-IInd at Obra ATPS. As these breakers are very old and sluggish, this fault was also sensed by other connected elements of 220kV Bus like Generator Unit No.1 & Generator Unit No.2, 240 MVA (220/400 KV) ICT-Ist & IInd, BTPS, It was also sensed and cleared by 220kV Obra- Allahabad circuit-III at Allahabad end in Zone-III. Thus the fault was cleared by the connected elements of 220kV Bus, isolating the Bus of ATPS, Obra.	1. SLDC should constitutes an internal committee for analyzing the tripping at Obra TPS and submit the detailed report within 1month to RPC/RLDC, covering following aspects: - Delayed Clearance of fault needs to be investigated. Exact sequence of event yet to be ascertained due to non-availability of DR/EL from the stations. Availability of DR/EL should be ensured. - Tripping of Obra (hydel) unit-1 on differential protection operation needs to be investigated and corrective action be taken. - Non tripping of 220kV Onra-Allahabad ckt3 from obra end needs to be investigated and corrective action be taken. - At Obra TPS, the tripping/opening time of all the 220kV circuit breakers be checked and set right. - At Obra TPS, the protection setting of all the 220kV side elements be checked and set right. - Protection coordination of different elements at Obra TPS needs to be reviewed. - 132kV level fault getting cleared from 400kV stations is cause for concern and need to be investigated. (Action: UPRVUNL, Time frame: 01 month) 2. Healthiness of bus bar protection/ Local breaker backup needs to be ensured. (Action:UPRVUNL, Time frame: 03 months) 3. At Obra TPS, over hauling/replacement of sluggish circuit breakers to be done. Action:UPRVUNL, Time frame: 01 months) 4. At Obra TPS, all the defective distance protection relays and transformer relays be replaced. (Action:UPRVUNL, Time frame: 02 months) 5. Availability of digital data needs to be ensured(Action: UPRVUNL, Time frame: 01 months) Remedial Action to be Taken (As per UP Report) :- 1. At Obra TPS, the tripping/opening time of all the 220 KV circuit breakers be checked and set right. (Action UPRVUNL) 2. At Obra TPS, the protection setting of all the 220 KV side elements be checked and set right. (Action UPRVUNL) 3. AT Obra TPS, over hauling/replacement of sluggish circuit breakers be done. (Action UPRVUNL) 4. AT Obra TPS, all the defective distance protection relays and transformer relays be replaced. (Action
36	Multiple Element tripping at 400kV Harsh Vihar	i) 08/10/2014 at 07:53 Hrs ii) 14/09/2014 at 17:50 Hrs	i) For first incident ~1250ms as per PMU data & DR details ; ii) For Second incident ~1350ms as per PMU data & DR details	Tripping of multiple elements at 400kV Harsh Vihar	PSC Conclusions: 1. Red-phase to ground fault occurred in 400kV Dadri-Harsh Vihar ckt2. Red phase breaker of the line tripped from Dadri end but Harsh Vihar end relay didn't trip. 400kV Dadri- Harsh Vihar ckt-1 tripped from Dadri end immediately after fault & Harsh Vihar end relay also tripped due to DT received from remote end. 400kV Dadri-Harsh Vihar ckt-1 might have tripped due to overreaching of distance protection. Fault was continuously feeding through other two phase(Y&B-phase) of ckt-2 as R-phase of the line didn't trip from Harsh Vihar end. 220/66kV ICT-1 & 3 tripped on backup earth fault protection due to zero sequence current which was fed to the fault from transformers due to presence of tertiary winding. 2. 210 MW unit-4 tripped on overall generator differential protection. 220kV ICT Y-phase CT secondary ckt was faulty (wire got earthed). 3. Harsh Vihar end of 400kV Dadri-Harsh Vihar ckt-2 didn't sense the fault in any zone. The fault current/Voltage recorded is 1298A/51.23kV which indicates very high impedance about 39ohms. Exact reason couldn't be concluded. The CT shorting links may be the probable reason. Same has been rectified at Harsh Vihar end. 4. PLCC panel of both ends of 400kV Dadri-Harsh Vihar ckt1 are healthy & DT (Direct Trip) was sent from Dadri end to Harsh Vihar end due to wiring problem of 400kV CB (manual trip close circuit). This problem has been rectified now. 5. There is no back feeding/ interconnections at Harsh Vihar station. 6. DR of Dadri & Harsh Vihar end was not time synchronized.	PSC Recommendations: 1. DR of Dadri & Harsh Vihar end needs to be time synchronized. (Action: DTL & NTPC; Time Frame: 7days) 2. Availability of digital data to be ensured. (Action: DTL & NTPC; Time Frame: 7 days)
37	Multiple Element tripping at 400/220kV Muzaffarnagar(UP) station	09/10/2014 at 13:10 Hrs	~960ms as per PMU data	Tripping of all the 220kV elements & 400/220kV ICT's at Muzaffarnagar	220kV Bus Bar differential protection not commissioned at 400/220kV Muzaffarnagar(UP) station. As reported Y-phase Jumper between Bus isolator & circuit breaker of 220kV Muzaffarnagar-Shamli snapped at 220kV Muzzafarnagar s/s. It was bus fault for 220kV Bus of 400/220kV Muzaffarnagar station. Due to non-availability of bus bar protection all the 220kV elements tripped from remote end & 400/220kV ICT's at Muzaffarnagar station tripped on backup over current protection. ICT's at Muzaffaranagar station tripped on backup over current & earth fault protection due to delayed clearance of fault. PSC Conclusions: 1. Y-phase Jumper between Bus isolator & circuit breaker of 220kV Muzaffarnagar-Shamli snapped at 220kV Muzzafarnagar s/s. It was bus fault for 220kV Bus of 400/220kV Muzaffarnagar station. Due to non-availability of bus bar protection, all the 220kV elements tripped from remote end & 400/220kV ICT's at Muzaffarnagar station tripped on backup over current protection. 2. Delayed Clearance of fault was due to unavailability of bus bar protection at 220kV side of 400/220kV Muzaffarnagar station. 3. Flag details have been received from UP. Preliminary & detailed report along with DR/EL were awaited from UP. 4. Digital data was not available at NRLDC	PSC Recommendations: 1. Bus Bar Protection at 400/220kV Muzaffarnagar station to be commissioned. (Action: UPPTCL; Time Frame: 3 months) 2. Implementations of numerical relays & extraction software for numerical relays to be made available. The activity was reportedly under progress. (Action: UPPTCL; Time Frame: 6 months) 3. Availability of Digital data needs to be ensured. (Action: UPPTCL; Time Frame: 15 days)

38	Multiple Element tripping at 400kV Gorakhpur(UP) station	14/10/2014 at 08:19 Hrs	~5640ms as per PMU data	Tripping of all the 400kV elements at 400kV S/S Gorakhpur & Tripping of Generating unit no. I (110 MW) at Tanda T.P.S.,	A fault took place simultaneously on both 220 KV Tanda-Sultanpur and Tanda-Gorakhpur lines (lines are on same towers & fault was at some distance from Tanda TPS. At 220 KV S/S Sultanpur, CB tripped on fault. At 220kV S/S Gorakhpur, delayed tripping occurred. 220kV Gorakhpur4- Gorakhpur2 ckt- I & II did not trip and therefore the fault was reflected on 400/220kV Gorakhpur (UP) Bus. This resulted in tripping of all the 400kV elements at 400kV S/S Gorakhpur due to operation of 96 relay (Bus Bar/ LBB Protection). However, 400kV Gorakhpur-Gorakhpur (PG)-II line did not trip on Bus Bar/ LBB protection operation at 400kV Gorakahpur(UP). At Tanda T.P.S., Generating unit no. I (110 MW) also tripped during this fault. PSC Conclusion: 1. It was concluded from available information that a fault took place simultaneously on both 220 KV Tanda-Sultanpur and Tanda-Gorakhpur(Barhua) lines (lines are on same towers) & fault was at some distance from Tanda TPS. At 220 KV S/S Sultanpur, CB tripped on fault. At 220kV S/S Gorakhpur, delayed tripping occurred. 220kV Gorakhpur4- Gorakhpur2 ckt- I & II did not trip and therefore the fault was reflected on 400/220kV Gorakhpur (UP) Bus. 2. Delayed clearance of fault was due to delayed opening of breaker at 220kV Gorakhpur (Barhua) station. Service engineer of firm of circuit breaker had been called for overhauling 3. Bus Bar Protection at 400kV Gorakhpur(UP) was out of service because of earlier misoperation of bus bar protection. It would be implemented within 6 months. 4. Only One main & backup protection was installed at 220kV Gorakhour(Barhua), Sultanpur, 220kV side of 400/220kV Gorakhpur(UP) station instead of two main & backup protection. 5. Tanda TPS unit tripped on Axial Shift High. At the same time all the incomers to UPS had failed and battery backup did not provide any backup. 6. Fault was observed in Y&B-phase of both Tanda-Gorakhpur line & Tanda-Sultanpur line & all three phase of the line tripped.	PSC Recommendations: 1. Bus Bar Protection to be corrected at 400kV Gorakhpur(UP) station. (Action: UPPTCL; Time Frame: 3 month) 2. Electromechanical relay of 220kV lines to be replaced by Numerical relay. (Action: UPPTCL; Time Frame: 6 month) 3. Breaker of 220kV Tanda-Gorakhpur(Barhua) line to be overhauled. (Action: UPPTCL; Time Frame: 2 month) 4. Two main & back up protection to be implemented in 220kV lines from 220kV Sultanpur, Gorakhpur (400/220kV) & 220kV Gorakhpur(Barhua) station. 5. Availability of digital data at NRLDC to be ensured (Action: UPPTCL; Time Frame:15 days) 6. Battery bank at 220kV Tanda TPS to be replaced. (Action: NTPC; time Frame: 1 month) 7. Availability of DR/EL & Downloading Software for extraction of DR/EL to be ensured. (Action: UPPTCL; Time Frame: 1 month)
39	Multiple Element tripping at 400kV Gorakhpur(PG) station	14/10/2014 at 09:20 Hrs	~560ms as per PMU data	Tripping of 400kV Gorakhpur(PG)-Muzaffarpur ckt-1 & ckt-2	In antecedent condition there was heavy rainfall and storm in that area. 400kV Gorakhpur(PG)-Muzaffarpur(PG) D/C tripped due to phase to phase fault. As per DR/EL of 400kV Gorakhpur(PG) end 400kV Gorakhpur(PG)-Muzaffarpur ckt-1 tripped on Y-B phase to phase fault. 400kV Gorakhpur(PG)-Muzaffarpur ckt-2 tripped on R-Y phase to phase fault. As fault was phase to phase, it resulted into tripping of all 3- phase of the line in zone-1 timing. Both lines tripped from Muzaffarpur end on carrier received from Gorakhpur(PG) end. PSC Conclusions: 1. Earth wire snapped and fall on both the tower of line & both t 400kV Gorakhpur-Muzaffarpur line tripped on phase to phase fault. Line distance protection got clear the fault within 100ms. 2. Reason of dip in the phase voltages of Balia PMU for 560ms couldn't be finalised.	PSC Recommendations: Breaker opening time at Gorakhpur(PG) & Muzaffarpur(PG) end needs to be checked. (Action: POWERGRID; Time Frame: 15 days)
40	Multiple Element tripping at 400/220kV Muradnagar station	21/10/2014 at 15:51 Hrs	~1120ms as per PMU data	Tripping of multiple Element at 400/220kV Muradnagar station	PSC Conclusions: 1. At 220kV S/S Muradnagar, B-phase lightening arrestor of 220kV Muradnagar(400)-Muradnagar (220) inter connector got damaged, which resulted in tripping of the above line from both the ends. 2. Distance protection setting & backup earth fault protection setting was delayed. 3. As 220 KV Muradnagar(400)-Muradnagar (220) inter connector is radial feeder thats why zone-2 setting has been changed to zero instead of 0.4second & TMS of backup earth fault setting has been changed to 0.2 instead of 0.3. 4. 400/220kV, 315 MVA, ICT-I & III of Muradnagar station had tripped on backup earth fault/ over current protection. 5. Delayed clearance of fault was due to failure of main & backup protection in 220kV Muradnagar(400)-Muradnagar (220) inter connector line. 6. Exact SoE couldn't be finalized due to non-availability of DR/EL. Numerical relays would be helpful in analyzing the event. 7. Data of disturbance recorder & Event recorder was not available at UPPTCL. 8. Tripping of 220kV Sahibabad-Muradnagar in Zone-4(As per flag details) was wrong operation. 9. At 400kV S/S Muradnagar, the time setting co-ordination was not proper between line Distance	PSC Recommendations: 1. Electromechanical relay of ICT's & 220kV lines should be replaced with Numerical relay. (Action: UPPTCL; Time Frame: 3 month) 2. Downloading Software for extraction of DR/EL to be ensured. (Action: UPPTCL; Time Frame: 1 month) 3. Tripping of 220kV Sahibabad-Muradnagar in Zone-4(As per flag details) need to be checked & corrected. (Action: UPPTCL; Time Frame: 1 month) 4. Availability of digital data of Muradnagar station needs to be ensured. (Action: UPPTCL; Time Frame: 15 days) 5. At 400kV S/S Muradnagar, the time setting co-ordination between line Distance Protection of 220 KV Muradnagar (400)-Muradnagar (220) line and 315 MVA, ICTs needs to be checked and attended. (Action: UPPTCL; Time Frame: 1 month)

41	Multiple Element tripping at 400/220kV Muzaffarnagar station	05/11/2014 at 10:31 Hrs	~1760ms as per PMU data	Tripping of multiple elements at 400/220kV Muzaffarnagar station	PSC Conclusion: 1. Y-B phase to phase fault occurred in 220kV Muzaffarnagar-Nara line. Fault got cleared from Nara end but distance protection at Muzaffarnagar end hanged. 220kV Muzaffarnagar-Nara line has only one distance protection & backup earth fault protection, instead of two distance protections& back up earth fault protection. On phase to phase faultbackup earth fault protection for the Muzaffarnagar end of the line did not operate but 400/220kV 315MVA ICT's at Muzaffarnagar end tripped on backup over current protection due to delayed clearance of fault. 2. 220kV Muzaffarnagar-Modipuram line tripped from Modipuram end due to back feeding from Modipuram station. 3. In interconnected system such type of trippings impacted on inter-regional power flow.In this case SPS of Raichur-Sholapur line also operated at the same time due to governor operation in Southern Region.Such type of events should be minimized for stability of the grid. 4. Many 220kV lines in UP system have one main & backup protection only.As per Para 3 of Schedule Part III. Grid Connectivity Standard applicable to the transmission line and sub-station-"Two main numerical Distance Protection Schemes shall be provided on all the transmission lines of 220 kV and above for all new sub-stations. For existing sub-stations, this shall be implemented in a reasonable time frame" 5. On 220kV and lower voltage lines with only one Main protection Back up protection by IDMT O/C and E/F to be applied.	PSC Recommendations: 1. Availability of two main distance protection in 220kV Muzaffarnagar-Nara line needs to be ensured. (Action: UPPTCL; Time Frame: 6months) 2. REL-670 relays at Nanauta end of Nanauta-Muzaffarnagar line and Shamli end of Muzaffarnagar-Shamli line to be checked.(Action: UPPTCL; Time Frame: 7 days) 3. On 220kV and lower voltage lines with only one Main protection, Back up protection by IDMT O/C and E/F to be applied.(Action: UPPTCL; Time Frame: 6months)
42	Multiple Element tripping at 400kV Jhakri HEP station	09/11/2014 at 21:31 Hrs	~100ms as per PMU data	Tripping of multiple elements at 400kV Jhakri HEP station	PSC Conclusions: 1. NathpaJhakri-KarchamWangtoo ckt-1 was opened manually from KarchamWangtoo end at 21:31hrs due to high voltage conditions. Accordingly, NJHPS breaker was opened through PLCC direct trip command received from KW end. 2. As soon as CB (Areva make) opened at NJHPS end at a grid voltage of 431KV, a flashover occurred in the R-Phase Circuit Breaker of NJ-KW ckt-I which was cleared by the Busbar Protection-I in 02 cycles. All the elements (Unit-6, NathpaJhakri-Rampur ckt1 &NathpaJhakri-Panchkula ckt-1) connected to Bus Bar-1 tripped. 3. The Maximum fault current observed was 18.20kA. 4. All the protection systems operated correctly & cleared the fault within time. 5. Digital data was not available at NRLDC SCADA system.	PSC Recommendations: 1. Data telemetry to be available by lease line in the meantime. (Action: NJHPS; Time Frame: 15days) 2. Reason of re-striking across breaker needs to be discussed with GIS vendor because such type of incidents had also occurred in the past. (Action: NJHPS)
43	Tripping of 400kV Bareilly-Unnao D/C	03/12/2014 at 04:11 Hrs	~160ms as per PMU data	Tripping of 400kV Bareilly-Unnao D/C	400kV Bareilly-Unnao ckt1 tripped on phase to ground fault & simultaneously phase to phase fault occurred on 400kV Bareilly-Unnao ckt2. PSC Conclusions: 1. Representative from UPPTCL was not familiar with the tripping at Unnao/ Bareilly S/S (Central-UP). 2. Simultaneous occurrence of fault in both the lines at the same time is rarest condition. 3. Due to non-availability of DR/EL data, event couldn't be analysed in details. However as per flag details it seems there was simultaneous fault in both 400kV Unnao-Bareilly line. 4. Availability of digital data of Bareilly/Unnao station needs to be ensured. 5. Availability of DR/EL & extraction software for DR/EL needs to be ensured.	PSC Recommendations: 1. Availability of digital signal also needs to be looked into. (Action: UPPTCL; Time Frame: 15days) 2. Representative of UPPTCL who is familiar with the events included in the agenda should attend the meeting. (Action: UPPTCL) 3. SLDC-UP to collect the details from the site & submit the same to RLDC/ RPC. (Action: UPPTCL; Time Frame: 15days) 4. Availability of Software for extraction of DR/EL to be ensured.(Action: UPPTCL, Time Frame: 1month)

44	Multiple element tripping in the night hours of 5th Dec 2014(UPPTCL)	05-12-14	(i) 1400kV Azamgarh-Sarnath ckt, 400kV Anpara-Sarnath D/C, 400kV Sarnath-Sasaram, 400kV Sarnath-Allahabad, 315MVA ICT #1 & 3 (Fault clearance time 560 ms) (ii) 400kV S/C Roorkee-Muzaffarnagar Line had tripped in Zone-2 (after time delay of 350msec). (iii)Confirm5400kV Azamgarh(UP)-Sarnath(UP)-1, 400kV Allahabad(PG)-Sarnath(UP), 400kV Sarnath(UP)-Sasaram(ER) (Fault clearance: 480 ms and 400 ms respectively	Multiple element tripping in the night hours of 5th Dec 2014(UPPTCL)	PSCConclusions: 1. UPPTCL should review protection related issues. Following points to be particularly taken care of forSarnathsub-station: a. Delayed Clearance of fault b. Multiple elements tripping on single line fault c. Non availability of digital data d. Availability of DR/EL. e. Availability of numerical relays f. Healthiness of 400/220kV Bus Bar Protection g. Protection Co-ordination of different elements h. Exact Sequence of event needs to be finalized. 2. Tripping at 400kV Roorkee-Muzaffarnagar&Roorkee-Rishikesh Line: a. It was informed telephonically that 400kV Roorkee-Muzaffarnagar line tripped due to snapping of conductor in the line. b. As per PMU data, max dip observed in Y-ph at two instances. (It seems line autoreclosed) c. As per POWERGRID report, 400kV S/C Roorkee-Muzaffarnagar Line tripped in Zone-2 (after time delay of 350msec) on Y-N fault at 06:10:21hrs due to non-receipt of carrier from remote end.From DR at Roorkee(PG) end, it seems that all three poles were tripped on single phase to ground fault and auto-reclosed from remote end. The carrier was not sent from remote end due to burning contact assigned for carrier send in REL670 relay (both Main-1 & Main-2 relays are of ABB make). 1. 400kV S/C Roorkee-Muzaffarnagar Line had tripped in Zone-2 (after time delay of 350msec) on Y-N fault at 06:10:21 hrs due to non-receipt of carrier from remote end.From DR at Roorkee(PG) end, it seems that all three poles had tripped on single phase to ground fault and auto-reclosed from remote end. The carrier was not sent from Muzaffarnagar end due to damaged contact assigned for carrier send in REL670 relay. 2. Roorkee-Rishikesh linehad tripped from Rishikesh end in zone-1 for fault outside its zone due to sensitive zone-1 setting at Rishikesh end. It was informed that the	PSC Recommendations: 1. REL 670 relay at Muzaffarnagar end of 400kV Roorkee-Muzaffarnagar line to be checked and corrected. (Action: UPPTCL; Time Frame: 1month) 2. Changes in the distance setting made at Rishikesh end of 400kV Roorkee-Rishikesh line to be furnished by PTCUL. (Action: PTCUL, Time frame: 15days). 3. Preliminary report, DR/EL & detailed report was awaited from UPPTCL& PTCUL for tripping of one or more elements. These entities should submit the detailed analysis report along with DR/EL of the events. (Action: UPPTCL & PTCUL, Tine frame: 7days).
45	Multiple element tripping at 400/220kV Sarnath Station	06/12/2014 at 05:22 Hrs	~120ms as per PMU data	Multiple element tripping at 400/220kV Sarnath Station	1. 400kV Sarnath is connected with five 400kv lines namely 400kV Sarnath-Anpara D/C, Sarnath-Sasaram S/C, Sarnath-AzamgarhS/C &Sarnath-Allahabad S/C. It's have two running 400/220kV 315MVA ICT-1 & 3. 2. At 05:22hrs phase to ground fault occurred in 400kV Anapra-Sarnath. At the same time 400/220kV ICT-1&3 also tripped due to backup earth fault/overcurrent protection. 3. Fault clearance time as per PMU data was ~120ms. Max dip in R-phase.After ~1050ms there was permanent dip in the voltage, corroborated some load loss. 4. As per PMU data it seems that single-phase to ground fault occurred in the line, line auto reclosed after 1000ms. Line tripped due to unsuccessful auto reclosing and ICT-1&3 also tripped.	1. Availability of digital data needs to be ensured.(Action: UPPTCL, Time:6 months) 2. Preliminary Report, DR/EL & Detailed Report from UP was awaited. UPPTCL should submit these report along with reason and exact Sequence of tripping.(Action: UPPTCL, Time: 7 days)
46	Multiple Element tripping at 400/220kV Muzaffarnagar station	23/12/2014 at 01:52 Hrs	~1040ms as per PMU data	Tripping of all the 220kV lines at remote ends and 3X315MVA ICTs	PSC Conclusions: 1. At 01:52hrs of 23.12.2014 a (R-phase to earth) line fault took place on 220kV Muzaffarnagar-Charla line. At Muzaffarnagar S/S, Line distance protection operated but R pole of CB exploded resulting into permanent fault in the line. As Bus bar Protection is not available at 220kV Muzaffarnagar station, it resulted into tripping of all the 220kV lines at remote ends and 3X315MVA ICTs on over current /earth fault protection 2. Line distance protection of 220kV Muzaffarnagar-Nanauta line didn't operate. 3. Exact reason of delayed clearance of fault couldn't be ascertained due to non-availability of time stamped data. 4. Distance protection in 220kV Muzaffarnagar-Modipuram line didn't operate. 5. Time synchronization of digital data & availability of digital data to be checked.	PSC Recommendations: 1. Bus Bar Protection at 400/220kV Muzaffarnagar station to be commissioned. (Action: UPPTCL; Time Frame: Till Sep-2015) 2. Distance Protection of 220kV Muzaffarnagar-Modipuram line to be checked & corrected. (Action: UPPTCL; Time Frame: 15days) 3. Distance Protection of 220kV Muzaffarnagar-Nanauta line to be checked & corrected. (Action: UPPTCL; Time Frame: 15days) 4. Implementations of numerical relays & extraction software for numerical relays are reported to be under progress. The same needs to be completed early. (Action: UPPTCL; Time Frame: 3months) 5. Availability of Digital data needs to be ensured. (Action: UPPTCL; Time Frame: 15days)
47	Multiple element tripping at 220kV Ropar TPS	05/01/2015 at 04:53 Hrs	~320ms as per PMU data	Tripping of Unit-1 & 4 of Ropar station	No representative from PSPCL presented in the meeting	Submit the details analysis report of the event to RPC/ RLDC considering the points for the discussion mentioned above. (Action: PSPCL, PSTCL, Time Frame: 15days)
48	Tripping of Vindhyachal BtB Blocks & 400kV Vindhyachal-Singrauli D/C line	19/01/2015 at 22:39 Hrs	~200ms as per PMU data	Tripping of Vindhyachal BtB Blocks & 400kV Vindhyachal-Singrauli D/C line	PSC Conclusions: 1. Vindhyachal HVDCBtB station was running with 50MW, West to North direction and both HVDC Blocks-1&2 were in joint mode of operation. At 22:39hrs, Block-2 tripped on short ckt protection, DC ground fault protection & DC over current protection. Due to breaker failure of block-2, bus bar protection operated for Bus-1A but due to wrong selection isolators of newly commissioned bus reactor at vindhyachal, bus bar protection for other bus also operated. It resulted into tripping of all the elements connected to North buses. 2. DR/EL data of Vindhyachal stationwas nottime synchronized.	PSC Recommendations: 1. Better Monitoring tools to be used for isolator selection in DMT scheme. (General Recommendation for all the utilities) 2. DR/EL data of Vindhyachal station to be time synchronized. (Action: POWERGRID, Time Frame: 15days) 3. Availability of digital data needs to be ensured. (Action: POWERGRID, Time: 15 days)

49	Multiple Element tripping at 400/220kV Daultabad station	14/02/2015 at 17:15 Hrs	~2760ms as per PMU data	Multiple Element tripping at 400/220kV Daultabad station	Protection Committee Conclusion: 1. In antecedent condition bus bar protection at 220kV Daultabad station was under outage due to replacement work of the same. ABB make static bus bar was being replaced withER make numerical relay.R-phase CT of Daultabad-Nunamajra ckt1 busted. It resulted into falling of jack bus on main bus. At the same time all 3 no. of 400/220kV ICTs at Daultabad (HVPN) also tripped due to earth fault protection. 2. Non availability of bus bar protection and clearance of fault after tripping of all three ICTs on earth fault protection resulted into delayed clearance of fault. 3. Bus Bar Protection has put into service from 11.03.2015. 4. Multiple element tripping due to operation ofback up protection of ICTs as bus bar protection of 220kV bus didn't operate. 5. DR/EL of the tripping didn't provide by the Haryana. 6. Digital data didn't available from 400/220kV Daultabad station.	Protection Committee Recommendations: 1. Healthiness of Bus Bar Protection to be ensured. (Action: Haryana; Time Frame: 15 days) 2. Reason of tripping of tie CB of 400kV Daulatabad-Dhanonda-2 needs to be looked into. (Action: Haryana; Time Frame: 15 days) 3. Availability of DR/EL of Daultabad station to be ensured. (Action:Haryana; Time Frame: 1 months) 4. Availability of digital data of 400/220kV Daultabad station to be ensured. (Action: Haryana; Time Frame: 1 months) 5. Availability of standalone automatic downloading facility of DR/EL in the sub-station to be ensured. (Action: All the NR Constituent; Time Frame: 3months) 6. Haryana is continuously violating the IEGC clause 5.2.r & CEA Grid Standard 5.3 as Detailed report, DR/EL has not been received from Haryana in past also.
50	Kashmir Valley Collapse	02/03/2015 at 05:20 Hrs & 06:50 Hrs	~300ms as per PMU data	Kashmir Valley Collapse	Protection Committee Outcome: 1. In antecedent condition, there was snowfall in valley area due to snowfall, valley load become very low and it resulted into widespread over voltage in that area. For controlling the voltage, 400kV Kishenpur-Moga ckt-1 manually opened at 00:12hrs, 400kV Kishenpur-Dulhasti manually opened at 00:47hrs & Kishenpur-Chamera2 manually opened at 03:02hrs.After opening/tripping of many 400kV lines in that area, 400kV Kishenpur station is loosely connected with the grid. At 06:50hrs, B-phase to ground fault occurred in 220kV Kishenpur-Sarna ckt-1& ckt-1 tripped in zone-1 time. At the same time 220kv Kishenpur-Sarna ckt-2 also tripped due to resistive reach setting problem. After tripping of both 220kV Kishenpur-Sarna ckts, Kishenpur is connected with one ckt of Moga (ckt-2). Power flow rose upto 2500Amp on 400kV Kishenpur-Moga ckt-2. This line tripped in zone-1 due to resistive reach setting problem in Micom relay. 2. Resistive reach setting in has been changed according to Ramakrishna committee report. 3. Reason of tripping of Chamera-II HEP units as 400kV Chamera-II Chamba ckt already under charged condition: Chamba didn't connect with rest of the grid. As 400kV Chamera2-Chamba ckt under charged condition without any power flow.	1. Non-auto reclosing of 220kV Sarna-Kishenpur ckt-1 from Kishenpur end to be checked & corrected. (Action: POWERGRID; Time Frame: 7days) 2. Setting of reverse zone at 220kV Sarna end of 220kV Sarna-Kishenpur D/C needs to be reviewed. (Action: POWERGRID; Time Frame: 7days) 3. NHPC may review the staggering in over frequency setting of Uri-I HEP units. (Action: NHPC; Time Frame: 7days) 4. PDD-J&K may review the staggering in over frequency setting of Uri-I HEP units. (Action: PDD-J&K; Time Frame: 15days) 5. Planned SPS for Kashmir valley to be expedited. (Action: PDD-J&K) 6. Installation of UFR & df/dt relays to be expedited.(Action: PDD-J&K)
51	Multiple Element tripping at 400/220kV Bassi(PG) station	05/03/2015 at 11:15 Hrs	~1120ms as per PMU data	Multiple Element tripping at 400/220kV Bassi(PG) station	1. Due to problem in Aux. switch of Bus-II isolator of Dausa-2, "CT switching incomplete" alarm was persisting and same was being rectified. During rectification, Bus-2 isolator closed inadvertently which converted into bus fault. In antecedent condition, bus bar protection was bypassed. Fault was on 220kV bust, all the elements tripped from remote end in zone-2 or zone-3 due to bypassing of bus bar protection. 2. Delayed clearance of fault persisted due to non-availability of bus bar protection in antecedent condition. 3. Bus bar protection was okay, it was manually bypassed for working on the isolator. Same has been put into the system after completion of the work. 4. PRD (Pressure Relief Device) 400/220kV ICT #3 of Bassi (PG) mal-operated.	1. PRD mal-operation of 400/220kV ICT-3 at Bassi (PG) end to be checked & corrected. (Action: POWERGRID; Time Frame: 1month) 2. Availability of time synchronized digital data to be ensured. (Action: POWERGRID; Time Frame: 1month)

52	Complete Outage of 400kV Bareilly(UP) station	21/03/2015 at 08:59 Hrs	~1120ms as per PMU data	Tripping of 400kV Bareilly(UP)-Unnao-D/C, 400kV Bareilly(UP)-Bareilly-D/C & 315MVA, 400/220kV ICT-I and II at Bareilly(UP)	1. In antecedent condition, bus bar protection was under outage due to commissioning of new 400/220kV ICT-3 at Bareilly (UP). Although this ICT was charged through transfer breaker. Outage of bus bar protection didn't require for charging of third ICT. 2. Y-phase to earth fault occurred on the main bus-1 due to falling of stell wire used for kite flying. As bus bar protection was not available, this bus fault resulted into tripping of all the 400kV lines from remote end in zone-2 or zone-3 and 400/220kV 315MVA ICTs tripped on backup earth fault/ over current protection. 3. Delayed clearance of fault was due to non-availability of bus bar protection at 400/220kV Bareilly (UP) station. 4. DR/EL couldn't be extracted due to occurrence of many tripping after the incident and relay have limited memory. 5. Action taken by UPPTCL: a. M/s ABB have been assigned the work to supply necessary hardware and commissioning of busbar wiring of ICT-3. b. Relays of Unnao end of 400kV Bareilly-Unnao line has been checked & tested during routine testing and found normal. c. M/S ABB has inspected old RDSS bus bar protection at the site and process has been initiated for work of recommissioning of busbar protection by them. d. All relays except of 220kV Dhauliganga & Pithoragarh have been time synchronized with GPS clock. e. Reverse zone timing has been reduced to 160ms with reach of 2kM in reverse direction. f. Event logger commissioned on Unnao-1,2 line & ICTs. g. Bus coupler breaker didn't open during the incident. Same has been replaced on 21.09.2015 6. Time synchronization of digital data to be looked into.	1. Availability of new numerical bus bar protection to be ensured. (Action: UPPTCL; Time Frame: 2months) 2. Distance zones setting of 400kV Bareilly-Unnao line to be reviewed according to Ramakrishna committee task force recommendations. (Action: UPPTCL; Time Frame: 7days) 3. Availability of time synchronized digital data to be ensured. (Action: UPPTCL; Time Frame: 7days) 4. Availability of DR (Disturbance recorder)/EL (Event logger) to all the 400&220kV element at 400/220kV Bareilly(UP) station to be ensured. (Action: UPPTCL; Time Frame:45days) 5. Availability of automatic download facility of DR & standalone EL to be ensured. (Action: UPPTCL; Time Frame:45days)
53	Complete Outage of 400/220kV Sultanpur Station	01/04/2015 at 22:22 Hrs	~420ms as per PMU	Complete Outage of 400/220kV Sultanpur Station	-	1. Availability & Healthiness of bus bar protection scheme at 400kV Sultanpur station to be ensured. (Action: UPPTCL; Time Frame: 1months) 2. Reason of delayed clearance of fault couldn't conclude due to non-availability of complete DR/EL & time synchronized digital data. 3. Availability of time synchronized digital data to be ensured. (Action: UPPTCL; Time Frame: 7days) 4. Availability of DR (Disturbance recorder)/EL (Event logger) to all the 400&220kV element at 400/220kV Sultanpur (UP) station to be ensured. (Action: UPPTCL; Time Frame:45days) 5. Availability of automatic download facility of DR & standalone EL at 400kV Sultanpur (UP) to be ensured. (Action: UPPTCL; Time Frame:45days)
54	Complete outage of 400/220kV Muradnagar(UP) station	08/04/2015 at 05:36 Hrs	~6sec as per PMU, DR & SCADA SoE data	Complete outage of 400/220kV Muradnagar(UP) station	-	1. UPPTCL reported that standalone event logger facility would be available at 400/220kV Muradnagar end by the end of October-2015. 2. Reason ofdelayed clearance of fault in case of busbar protection couldn't conclude due to non-availability of time synchronized digital data, DR/EL details. 3. Healthiness of bus bar protection at 400/220kV Muradnagar end to be checked & corrected. (Action: UPPTCL; Time Frame: 15months) 4. Manual checking of VAJC relay (isolator selection switch) in case of isolator operation to be properly monitored. (Action: UPPTCL; Time Frame: 15months) 5. Availability of all digital data of Muradnagar sub-station in NR SCADA & its time synchronization needs to be ensured. (Action: UPPTCL; Time Frame: 15months)
55	Complete Outage of 220kV Raebareilly(PG)	10/04/2015 at 13:53 Hrs	~480ms as per PMU, DR & SCADA SoE data	Complete Outage of 220kV Raebareilly(PG)	220kV Raebareilly(PG) station have five 220kV ckts: one ckt to Chinhat, one ckt to Lucknow(UP) & three ckt to Unchahar TPS. It has DMT (Double main transfer) scheme. On 10-April-15, a wire was found hanging from top of gantry to insulator string Y-phase of bus coupler & it is reaching up to 7th insulator disk causing flashes whenever wind blows. Shutdown of 220KV Bus-2 was requested for removal of wire which may cause bus fault in future if left unremoved. At that time ICT-2, Chinhat & Unchahar-2 circuits on Bus -2. To avail Bus Shutdown, ICT-2, Chinhat & Unchahar-2 needs to be transferred to Bus -1 for removal of wire from Bus Coupler Gantry. At first, ICT-2 was shifted to Bus-1. During transfer of Unchahar Line-2, after closing of Bus-1 Isolator, tripping incident took place during opening of Bus-2 Isolator. During transferring the feeders from Bus-2 to Bus-1, Bus Coupler was inadvertently remained open. As both isolators for Unchahar Line-2 was in closed condition, Bus Bar protection (RABH relay) was remain in blocked condition and all feeders tripped form remote end in Backup zones.	1. Tripping was basically due to manual error during isolator switching. Measures should be taken to ensure that such events do not get repeated. These events may provide fatal to the operator. Portection Committee Outcome & Recommendations: 2. Fault cleared with time delay due to blocking of bus bar protection in 220kV Raeareilly (PG) station and finally all the 220kV lines tripped from remote end in zone-2 timing. 3. Blocking of the bus bar protection during shifting of the isolator is not a healthy practice. Bus bar protection scheme to be reviewed 4. Unchahar unit tripped due to drop in the contractor of auxiliary supply of LT side of the unit. 5. Healthiness & setting of 220kV bus bar protection scheme at 220kv raebareilly (PG) to be reviewed. (Action: POWERGRID; Time Frame: 15days) 6. Senstitve setting of auxiliary contractor of unchahar units to be corrected. It may be coordinated with zone-3 setting of line protection. (Action: NTPC; Time Frame: 15days). 7. Availability of digital data to be ensured. (Action: POWERGRID, NTPC; Time Frame: 15days)

56	Complete outage of Harduaganj station and one unit tripping at NAPS	16/04/2015 at 11:15 Hrs	~3240ms as per PMU data	Complete failure of 220kV supply at Harduaganj TPS & adjoining areas	At 11:15hrs, Y-phase CT of 220kV Harduaganj-Jahangirabad ckt2 bursted at 220kV Harduaganj station. It resulted into bus fault for 220kV Harduaganj station but bus bar protection was not in service. It resulted into tripping of all the elements from remote end. Onlu running unit-9 of Harduaganj station also tripped due to non-clearance of fault. Therefore complete 220kV supply failed at Harduaganj TPS & adjoining areas. Also at NAPS, unit no. I tripped at the same time. NAPS-Atrauli tripped at NAPS end through E/F protection as fault was not cleared at Atrauli end protection. NAPS-Khurja-1&2 tripped at NAPS end through ABC, Z3 fault protection as fault was not cleared in time at Khurja end. However at same time BFR relay for NAPS-Khurja line-2 also got operated which led to tripping of GT-1, SUT-2 NAPS-Simbholi line, NAPS- Atrauli line (already tripped on E/F). Tripping of GT-1 on BFR of NAPS-Khurja line-2 resulted in over speeding and changes in process parameters and caused tripping of Turbine Generator-1 and subsequently reactor trip.	1. NAPP may look into the issue of poisoning of nuclear reactor. Further improvement to be expedited. (Action: NPCIL; Time Frame: 2months) 2. Availability of time synchronized digital data to be ensured. (Action: NPCIL, UPRVUNL; Time Frame: 1months) 3. Availability of DR/EL facility at the 220kV Harduganj, Khurja, Mainpuri, Atrauli, Jahagirabad, Khair, Etah etc to ensured. (Action: UPPTCL,UPRVUNL; Time Frame: 3months) 4. Availability of bus bar protection at 220kV Harduaganj station to be expedited. (Action: UPRVUNL; Time Frame: 1months) 5. Overall protection system of 220kV Harduaganj & nearby area needs to be checked & corrected& Protection co-ordination also needs to be reviewed. (Action: UPRVUNL; Time Frame: 1months) 6. Zone-2 & 3 settings are the associated line from Harduaganj to be checked & corrected.(Action: UPRVUNL; Time Frame: 1months) 7. Independent third party Protection Audit for 220kV Harduaganj station to be done. (Action: UPRVUNL; Time Frame: 2months)
57	Multiple Element tripping at 400/220kV Bhiwadi(PG) and 500kV Balia-Bhiwadi Bipole	29/04/2015 at 16:42 Hrs	~1320ms as per PMU data	Multiple Element tripping at 400/220kV Bhiwadi(PG) and 500kV Balia-Bhiwadi Bipole	Due to B-ph CT failure of 220 kV Bhiwadi-Rewari ckt, 220kV Bhiwadi(PG)-Kushkhera(RVPNL) D/C, 220kV Bhiwadi(PG)-Rewa SPL(HVPNL) & 500kV Balia-Bhiwadi bipole tripped Operator working on 220kV Bhiwadi-Rewari line for attending the fuse failure, because one distance relay was blocked due to fuse failure. Operator opened the other fuse of the relay resulted into blocking of main-II distance protection and simultaneously fault occurred into the system. All the 220kV lines tripped from remote end in zone-2 & zone-3 timing. HVDC Balia-Bhiwadi bipole tripped on negative sequence over current protection. Delayed clearance of fault was due to blocking of distance protection in the line and lines finally tripped from remote end.	Digital data availability needs to be ensured. (Action: POWERGRID, Rajasthan; Time Frame: 15days) Sensitive setting of Negative sequence over current protection setting for Bipole to be checked & corrected. (Action: POWERGRID, Rajasthan; Time Frame: 15days)
58	Multiple Element tripping at 220kV Salal station	01/06/2015 from 21:52 Hrs to 23:15 Hrs	~2000ms as per PMU data	Tripping of 220kV unit-1 to 6 of Salal HEP (115MW), 220 KV Salal-Jammu ckt-1 & 2 and 220kV Salal-Kishenpur ckt-1,2,3&4		
59						