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**विद्युत मंत्रालय/Ministry of Power**  
**केन्द्रीय विद्युत प्राधिकरण/Central Electricity Authority**  
**विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग**  
**Power System Engineering & Technology Development Division**

दिनांक: 11.06.2025

सेवा में,

<As per attached list>

**विषय:** Report of Standing Committee of Experts on failure of EHV transmission towers failed during the period from January 2024 to December 2024-reg.

**महोदया/महोदय,**

You are kindly aware that a Standing Committee of Experts was constituted vide CEA Letter No -41/98/Secy/CEA/809 dated 24.09.199 and reconstituted vide CEA letter no. CEA/5-41(18)/Secy-2012/166 dated 08.08.2012 under Section 73, Clause (I) of the Electricity Act, 2003 to investigate the failure of 220 kV and above voltage class transmission line towers and recommend remedial measures to avert failures in future.

2. In this connection, a meeting of the Standing Committee of the Experts was held on 25.04.2025 at CEA HQ, New Delhi in hybrid mode to discuss the causes of failures of the transmission line towers reported by various utilities to CEA which had failed during the period from January 2024 to December 2024.
3. Based on the data provided by the Utilities and the deliberations during the meeting, the Report of the Standing Committee for the failure of the EHV transmission line towers that occurred during the period from January 2024 to December 2024 has been prepared and is enclosed herewith for kind information and necessary action please.

**Encl: as above**

**भवदीय,**

(भंवर सिंह मीना /Bhanwar Singh Meena)

Director (PSE&TD) and Member Secretary of the Committee

**Copy to:**

1. SA to Chairperson, CEA
2. SA to Member (PS), CEA
3. PA to Chief Engineer, PSE&TD, CEA

**Address List:**



सत्यमेव जयते

**क्षतिग्रस्त ट्रांसमिशन लाइन टॉवरों पर विशेषज्ञों की स्थायी समिति की रिपोर्ट  
(जनवरी, 2024 – दिसंबर, 2024)**

**REPORT OF THE STANDING COMMITTEE OF EXPERTS ON  
FAILURE OF EHV TRANSMISSION LINE TOWERS  
(JANUARY, 2024 – DECEMBER, 2024)**



**GOVERNMENT OF INDIA  
MINISTRY OF POWER  
CENTRAL ELECTRICITY AUTHORITY**

**May, 2025**



## Table of Contents

|                                                                                                                                   |    |
|-----------------------------------------------------------------------------------------------------------------------------------|----|
| 1. Background.....                                                                                                                | 3  |
| 2. Introduction.....                                                                                                              | 3  |
| 3. Deliberations held during Standing Committee Meeting.....                                                                      | 6  |
| 4. Statistics and Analysis of the EHV Transmission Line Tower failure.....                                                        | 13 |
| 4.1 Failure incidence intimation and report submission statistics.....                                                            | 13 |
| 4.2 General Statistics of Reported EHV Transmission Line Tower Failures.....                                                      | 14 |
| 4.3 Insights into Tower Failure Incidents during Past Years.....                                                                  | 21 |
| 5. Observations of the Committee.....                                                                                             | 22 |
| 6. Recommendations and Remedial Measures suggested by the Committee.....                                                          | 23 |
| Annexure-I: List of Participants.....                                                                                             | 26 |
| Annexure-II: Detailed Information of EHV Transmission Line Tower Failure Cases as Reported by Various Transmission Utilities..... | 28 |
| 1. POWERGRID.....                                                                                                                 | 29 |
| 1.1 400 kV D/C Kishenpur-New Wanpoh III & IV.....                                                                                 | 30 |
| 1.2 400 kV D/C Silchar-Imphal Transmission line.....                                                                              | 33 |
| 1.3 400 kV D/C Gaya- Koderma Transmission Line.....                                                                               | 37 |
| 1.4 400 kV D/C Kishenpur-New Wanpoh III & IV.....                                                                                 | 41 |
| 1.5 400 kV D/C Abdullapur-Bawana / Deepalpur-Bawana.....                                                                          | 45 |
| 1.6 765 kV S/C Gwalior-Agra #1.....                                                                                               | 48 |
| 2. ADANI.....                                                                                                                     | 52 |
| 2.1 765 kV D/C BILASPUR – RAJNANDGAON TRANSMISSION LINE -Circuit 1 & 2.....                                                       | 52 |
| 2.2 765 kV 765 kV S/C AKOLA (2) – EKTUNI LINE – 2.....                                                                            | 56 |
| 3. RVPN 59.....                                                                                                                   |    |
| 3.1 220 kV MIA-BTPS LINE.....                                                                                                     | 59 |
| 3.2 400 kV D/C Bhadla-Jodhpur-Merta Line.....                                                                                     | 62 |
| 4. MSPCL.....                                                                                                                     | 64 |
| 4.1 400 kV Imphal – Thoubal Line.....                                                                                             | 64 |
| 5. HVPNL.....                                                                                                                     | 69 |
| 5.1 220 kV D/C Sohna Road -Rangala Rajpurline.....                                                                                | 69 |
| 6. MPPTCL.....                                                                                                                    | 73 |



|      |                                                                                          |     |
|------|------------------------------------------------------------------------------------------|-----|
| 6.1  | 220kV Rewa (220 kv) -Rewa (RUMSP) ckt-I & ckt-II & 220 kv Sidhi (RUMSP) ckt-I & Ckt II:  | 74  |
| 6.2  | 400 kV DCDS Malwa TPH (SSTPH)- Pithampur Ckt. I & II line.....                           | 77  |
| 6.3  | 220 kV Satna (220 kv) - Rewa & 220 kv Satna – Manpur (Adani) line .....                  | 80  |
| 7.   | Delhi Transco .....                                                                      | 83  |
| 7.1- | 220 kV Transmission tower failure reports - 220 kV Kashmere Gate-South of Wazirabad .... | 83  |
| 8.   | DVC                                                                                      | 86  |
| 8.1  | 220 kV D/C Line 203 & 204 (CTPS-DHANBAD) .....                                           | 86  |
| 8.2  | 400 kV L#407,408 (400 kV D/C RTPS- Ranchi T/L) Ckt 2, 3 .....                            | 88  |
| 9.   | NTPC                                                                                     | 93  |
| 9.1  | 400 kV Dadri-Harsh Vihar Ckt-1&2 .....                                                   | 93  |
| 10.  | AP TRANSCO .....                                                                         | 96  |
| 10.1 | 220 kV VSS - Parawada.....                                                               | 96  |
| 10.2 | 220 kV Pendurthi -Upper Sileru line .....                                                | 99  |
| 11.  | MSETCL .....                                                                             | 101 |
| 11.1 | 220 kV Khaperkheda- Butibori I Ckt & 220 kV Khaperkheda- Butibori III Ckt.....           | 101 |
| 11.2 | 400 kV CHD-II-Warora D/C Line .....                                                      | 105 |
| 11.3 | 220 kV Lamboti -Pandharpur Line & 220 kV Lamboti - Karkamb Line.....                     | 108 |
| 11.4 | 220 kV Girwali-Parli Ckt-2 & 220kV Parli-PGCIL Ckt-2 DC line .....                       | 111 |
| 12   | GETCO .....                                                                              | 115 |
| 12.1 | 220 kV Nanikhakhar-Nakhatrana D/C line .....                                             | 117 |
| 12.2 | 220 kV Akri Nakhtrana/Akri Bhachunda Line .....                                          | 120 |
| 12.3 | 220 kV Tappar- Vondh line .....                                                          | 123 |
|      | Annexure-III: Proforma for Reporting of Failure of EHV Transmission Line Towers .....    | 127 |



## 1. Background

Under Section 73, Clause (I) of the Electricity Act, 2003, CEA, vide office order no: 5-41/98/Secy/CEA/809 dated 24.09.199, constituted a Standing Committee of Experts in the field of design and operation of EHV transmission line towers from CEA, CPRI, various transmission utilities and research/academic institutes to investigate the failure of 220 kV and above voltage class transmission line towers and recommend measures to avert recurrence of such failures in future. The Committee was reconstituted vide CEA office order no: CEA/5-41(18)/Secy-2012/166 dated 08.08.2012.

The objective of the Standing Committee is to investigate the causes of failures, deliberate the failures of transmission line towers of various Power utilities, suggest remedial measures to prevent recurrence of such events in future and prepare a report which would serve as a repository of case studies of failures and suggested remedial measures for future.

As per CEA (Measures relating to Safety and Electric Supply) Regulations, 2023, all utilities are required to report any event of failure of 220 kV & above voltage class transmission line towers within 48 hrs, and submit a detailed report to CEA as per stipulated format (available on CEA website and is enclosed at **Annexure-III**) covering reasons for failure and measures taken/ to be taken to avoid recurrence of such failures. As part of this activity, CEA has been receiving reports of failures of various Towers of 220 kV and above voltage class transmission lines from power utilities.

In this connection, a meeting of the Standing Committee of Experts to investigate the failure of 220 kV and above voltage class Transmission Line Towers period that occurred during the period from January, 2024 to December, 2024 was held on 25.04.2025 at CEA HQ, New Delhi in hybrid mode under the Chairmanship of Chief Engineer (PSE&TD), CEA and Chairman of the Standing Committee. List of participants is given at **Annexure-I**.

## 2. Introduction

**Sh. N.R.L.K. Prasad, Chief Engineer (PSE&TD), CEA and Chairperson of the Standing Committee**, extended warm welcome to all the Members and Participants, and gave a brief background about the formation and mandate of the Standing Committee. He stated that to enable Standing Committee carry out its work, it is important that the Utilities report the instances of failures in their network/ system well within time as per regulatory provisions, and facilitate proper analysis of their respective events by the Committee by undertaking site visits, if required, in time.



It was informed that as per Regulation 48 (8) of CEA (Measures relating to Safety and Electric Supply) Regulations, 2023, failures of any 220 kV and above voltage level transmission line tower shall be reported by the owner utility within 48 hours of occurrence of the failure, to the Authority, and the reasons for failure and measures to be taken to avoid recurrence of failure shall be sent to the Authority within one month of the occurrence as per stipulated formats, alongwith all the additional information (images, duly filled CEA Proforma, wind speed data, coordinates of failed towers, patrolling data, material test reports). He requested all utilities to adhere to these timelines strictly.

He expressed concern that many utilities are not intimating/ notifying failure cases within 48 hours and are also failing to submit detailed failure reports within one month. He also raised concern w.r.t. non-participation of the Utilities, who have reported failure incidences, in the meeting. It was noted that out of the 12 Utilities who have reported failures, representatives from only 8 Utilities attended the Standing Committee meeting. No representative from APTRANSCO, MSETCL, GETCO, NTPC had attended the meeting.

In this regard, he brought attention of the forum to the recommendations of the Task Force on Cyclone Resilient Robust Electricity Transmission and Distribution (T&D) Infrastructure in Coastal area [Report brought out in May, 2021], and examine the same for appropriate adoption. Specific mention was made to the following points:

➤ Planning aspects:

- Mapping of T&D infrastructure in cyclone affected areas
- Digitization of Spares and Inventory Management of transmission system assets using suitable software like SAP [It was stated that for assessing requirement of minimum spares and ERS, Central Electricity Authority's "Guidelines for availability of spares and inventories for power transmission system (transmission lines & substation / switchyard) assets" issued in July 2020 may be followed]
- Use of Unmanned Aerial Vehicles (Drones)

➤ Design & Technology aspects:

- Measures for strengthening existing transmission lines
- Measures for future/ new T&D infrastructure

(i) Change in Design Loads (Pg No: 47)

- Reliability Level as per Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022
- Wind zones as per revised wind map
- Use of terrain Category- I for transmission lines ( $k_2 = 1.08$ )
- Introduction of  $K_4$  factor (of 1.3) for structures of industrial and post-cyclone importance
- Change in drag coefficient

(ii) Modification in configuration of transmission towers

(iii) Use of Narrow base lattice towers in coastal areas

(iv) Use of Steel Poles for lines in coastal areas



- (v) Foundation and reinforcement of foundation of transmission towers
  - Use of Pile foundation
  - Raised Chimney for flood prone areas
- (vi) Minimising corrosion of tower members
- (vii) Earthing & Lightning Protection of Transmission lines
- (viii) Use of New Generation conductors
- (ix) Material Quality, workmanship & maintenance practices

He also stated that reliability level as mentioned in Regulation 85 (4) (g) of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022) should be considered for design of towers and steel pole structures. As per Regulation 85 (4) (g):

|                                                                                                                                                                            |                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| 66 kV to 400 kV Transmission lines with one or two circuits and one or two conductors per phase                                                                            | Reliability level 1 corresponding to 50 years return period  |
| 66 kV to 400 kV Transmission lines with more than 2 circuits; 400 kV Transmission lines with more than two conductors per phase; Above 400 kV transmission lines           | Reliability level 2 corresponding to 150 years return period |
| Special towers or Pole; Tall River crossing towers or Pole; Multi Circuit towers or Pole whose full scale prototype cannot be tested due to limitation of testing facility | Reliability level 3 corresponding to 500 years return period |

He stated that since wind plays an important factor in the design of transmission towers, obtaining accurate wind speed data relevant to tower failure incidents would be helpful in verifying the effectiveness of the tower design, and enable utilities to improve the same. In this regard, the proposal of installing wind sensors at appropriate locations would be discussed later in the meeting.

He requested all utilities that while presenting their respective events, they also furnish a brief on the action taken by various utilities w.r.t. recommendations given by the standing committee in their past meetings such as implementation of Asset Monitoring System, undertaking regular O&M, installation of wind speed sensors and frequent patrolling/ monitoring in theft prone and cyclone prone areas, use of pile foundation in river/ creek bed/ scourable strata, etc.

He then requested **Sh. Bhanwar Singh Meena, Director (PSE&TD), CEA and Member Secretary of the Committee** to take up the Agenda.

Director (PSE&TD), CEA welcomed all participants and urged all utilities to promptly report tower failure incidents to facilitate timely site visits by the committee. He stressed on the importance of analyzing and identifying the root causes of these failures while submitting detailed reports. He also advised utilities to coordinate with the Indian Meteorological Department (IMD)/ Airport Authority of India (AAI) to obtain wind speed data at the failure locations, as wind has been identified as a major factor in tower collapses. Obtaining wind speed data from an authentic observatory is crucial to determining whether wind speed exceeded the design specifications of the towers. Such data can inform necessary modifications in design parameters to prevent future failures. He encouraged active participation in the deliberations to determine the causes of these failures and to propose remedial measures to prevent future occurrences.

He informed that for the period of January 2024 to December 2024, a total of 28 incidents of failure of EHV transmission line towers were reported to CEA by 12 Utilities (PGCIL, ADANI, RVPN, MSPCL, APTRANSCO, MSETCL, HVPNL, GETCO, MPPTCL, DTL, DVC, and NTPC) which included failure of 68 Nos. of Suspension Type Towers and 08 Nos. of Tension Type Towers. It was also added that failure of only Ten (10) Nos. of Transmission Lines of Four (4) Nos. of utilities had been intimated within 48 hours and detailed failure report of only Fourteen (14) Nos. of Transmission Lines of Eight (8) utilities had been submitted within one month.

Thereafter presentations by Utilities for their respective failure incidents were held. The failure incidents and their subsequent findings were deliberated upon by the members of the committee.

### 3. Deliberations held during Standing Committee Meeting

1. A total of 28 Nos. of EHV Transmission Line tower failure incidences consisting of 68 nos. of Suspension Type Tower and 08 nos. of Tension Type Towers were reported between 1st January 2024 and 31st December 2024 by 12 Utilities (PGCIL, ADANI, RVPN, MSPCL, APTRANSCO, MSETCL, HVPNL, GETCO, MPPTCL, DTL, DVC, and NTPC). Complete details of all the reported EHV Transmission Line Tower failures are given at **Annexure-II**. The details of the deliberations of the standing committee are presented in the ensuing paragraphs.
2. The Representative of **PGCIL** presented failures of 6 nos. of transmission lines covering total 15 nos. of Towers (10 nos. of Suspension Type Tower and 5 nos. of tension Type Tower). The transmission line wise deliberations are as under:
  - (i) **400 kV D/C Kishenpur-New Wanpoh III & IV transmission line:** In 400 kV D/C Kishenpur-New Wanpoh III & IV transmission line, 1 no. of tension type tower (DB+6) collapsed at tower location number 144. The line was commissioned in the year 2017 and the line length is 135 km. The reported cause of the failure is sliding/ sinking of landmass around tower number 144.

Director (PSE&TD), CEA informed the committee that in April 2020, sinking of foundation at location No. 144 was observed by POWERGRID site officials in which internal committee of Powergrid recommended for geological investigation of the land mass and in October, 2021 also there was a failure case in the same line at tower location no. 145 due to shifting of lower side tower no. 144 due to land sliding and at that time the Standing Committee advised M/s. Powergrid to ensure that the geological investigation of the land mass should be carried out and accordingly necessary strengthening measures required for tower foundations and/or for the hill slope should be taken, so that such incidences do not repeat. However, action is still pending and land sliding/sinking repeated at location no. 144 due to which tower got failed.

PGCIL representative mentioned that due to construction activities landslide and land sinking is common in that area. Chief Engineer (PSE&TD), CEA inquired about the nearby towers in response of which Representative of PGCIL said that the nearby towers were checked and found in good condition.

- (ii) **400 kV D/C Silchar-Imphal Line:** In 400 kV D/C Silchar-Imphal Line, 1 no. of tension type tower (DC+3) at Tower Location Number 421 got failed. The line was commissioned in the year 2015 and line length is 172 km. As per reported probable cause of failure, unknown miscreant damaged two legs of tower through highly powerful IED. The regional site members of PGCIL visited the site and they found that 02 stubs damaged & dislocated from Foundation, tower legs damaged & deformed to line route towards Ckt#2, stub (A & B) found intact and no missing members and nuts & bolts found. Director (PSE&TD), CEA mentioned that the restored tower should be designed as per latest IS, i.e., IS 802: 2015.
- (iii) **400 kV D/C Gaya-Koderma Transmission Line:** In 400 kV D/C Gaya-Koderma Transmission Line, 7 nos. of towers consisting of 5 nos. of (DA+0) towers and 02 nos. of (DA+3) towers collapsed. The line was commissioned in the year 2014 and line length is 125 km. Line is designed for Wind Zone 2. As per reported cause of failure, heavy localized cyclonic wind and thunderstorm are the main causes.

Chief Engineer (PSE&TD), CEA suggested that the wind speed data from the nearest airport may be taken to analyzing the cause of failure. Director (PSE&TD), CEA requested to check the restored tower strength as per IS 802: 2015 as the line was earlier designed as per IS 802: 1995.

- (iv) **400 kV D/C Kishenpur-New Wanpoh III & IV transmission line:** In 400 kV D/C Kishenpur-New Wanpoh III & IV transmission line, 3 nos. of tension type towers failed, i.e., 1 no. of (DC+0) type tower at location number 225, 1 no. of (DB+0) type tower at location

number 226 and 1 no. of (DD+3) type tower at location number 227. The line was commissioned in the year 2017 and the line length is 135 km. The reported probable cause of failure is sliding/ sinking of landmass around tower no. 225, 226 & 227.

Director (PSE&TD), CEA stated that there is a natural water stream above the tower locations along with the man-made trenches near the hill which might have lead to land sinking. He further suggested that proper patrolling is also required to avoid failure.

- (v) **400 kV D/C Abdullapur-Bawana / Deepalpur-Bawana line:** In 400 kV D/C Abdullapur-Bawana / Deepalpur-Bawana transmission line, 2 nos. of suspension type tower failed, i.e., 1 no. of (DA+0) tower at location no. 434 and 1 no. of (DA+6) tower at location no. 433. The line was commissioned in the year 2000 and the line length is 166.8 km. The reported probable cause of failure is Sabotage by Miscreants. Representative of PGCIL stated that around 40 nos. of tower members and bracings were found missing from the tower while visiting the site.

Chief Engineer (PSE&TD), CEA inquired about the patrolling frequency of the utility, to which representative of PGCIL informed that 3 different types of patrolling frequency routines are being followed by the PGCIL. In plain or normal areas patrolling frequency of 6 months is being followed and in critical areas patrolling frequency has been increased to three 3 months or 1 month. Chief Engineer (PSE&TD), CEA recommended to increase the patrolling frequency in theft prone areas. Director (PSE&TD), CEA suggested that assistance of local public in theft prone areas would be helpful.

- (vi) **765 kV S/C Gwalior-Agra transmission line:** In 765 kV S/C Gwalior-Agra transmission line, 1 no. of Suspension Type Tower (A+6) got failed. The line was commissioned in the year 2007 and the line length is 129.44 km. The reported probable cause of failure is Flash Flood in Asan River due to automatic opening of gates of Pagara Dam & Kotwal Dam.

Director (PSE&TD), CEA requested to submit the maximum flood discharge of the river, maximum velocity of water, highest flood level and stated that in flood prone and anticipated river course change areas pile type foundation shall be used. Chief Engineer (PSE&TD), CEA requested to take up with Dam Authority to ensure such discharge events are intimated well in advance so that remedial action could be taken.

3. The Representative of **ADANI** presented their failures of 2 nos. of transmission lines consisting of 8 nos. of suspension type towers. The transmission line wise deliberations are as under:

- (i) **765 kV D/C Bilaspur – Rajnandgaon Transmission Line -Circuit 1 & 2:** In 765 kV D/C Bilaspur – Rajnandgaon Transmission Line -Circuit 1 & 2, 4 nos. of suspension type tower got

collapsed. First, 765 kV D/C Bilaspur – Rajnandgaon Transmission Line -Circuit 2 at 10.05.2024, 18:04 hrs. got tripped followed by tripping of 765 kV D/C Bilaspur – Rajnandgaon Transmission Line -Circuit 1 at 10.05.2024, 18:12 hrs. The line was commissioned in the year 2019 and the line length is 162 km. The reported probable cause of failure is heavy sporadic whirl wind followed by localized cyclonic storm which might have exceeded the designed wind speed and damaged the towers no. 63 first and 3 Nos. of succeeding towers collapsed subsequently after gap of 8 Minutes. The line was designed for Reliability Level 2 and Wind Zone 2. They were designed as per IS 802: 1995. Director (PSE&TD), CEA suggested to check the restored tower strength as per IS 802:2015.

- (ii) **765 kV S/C Akola (2) – Ektuni Line:** In 765 kV S/C Akola (2) – Ektuni Line – 2, 4 nos. of suspension type towers failed. The line was commissioned in the year 2016 and the line length is 220 km. The reported probable cause of failure is sporadic heavy whirl wind followed by localized cyclonic storm with rainfall. The line was designed for Reliability Level 2 and Wind Zone 2. The Representative of ADANI informed that 765 kV S/C Tiroda – Koradi – Akola – Aurangabad (Ektuni) transmission lines transfer the bulk amount of power from North Eastern Maharashtra to critical load centers of Maharashtra like Mumbai, Pune and Aurangabad. He further added that in the past PGCIL has also experienced the suspension delta tower failures due to heavy localized whirl wind.

Director (PSE&TD), CEA suggested for the strengthening of delta type tower as per latest standards and Standing Committee recommendations to mitigate the failure issues.

- 4. The Representative of **RVPN** presented their failures of 2 nos. of transmission lines consisting of 7 nos. of suspension type towers. The transmission line wise deliberations are as under:

- (i) **220 kV MIA-BTPS LINE:** In 220 kV MIA-BTPS LINE, 2 nos. of suspension type towers got collapsed. The line was commissioned in the year 1976 and the line length is 131.7 km. The reported probable cause of failure is the sudden thrust arising due to conductor cutting by unknown thieves. The representative of RVPN said that their line was targeted by thieves and more than twenty five attempts of theft were made by unknown miscreants in Nuh (Mewat) region of Haryana and for that 21 nos. of F.I.R had already been lodged. He further added that as the line is approximately 50 years old and has no power flow since 2020 due to shut down of the BTPS Station. The RVPN management were of the view to dismantle the 220 kV MIA-BTPS Line. Director (PSE&TD), CEA mentioned that the details of failure report needs to be submitted with all the requisite data.

- (ii) **400 kV D/C Bhadla-Jodhpur-Merta Line:** In 400 kV D/C Bhadla-Jodhpur-Merta Line, 5 nos. of suspension type towers got collapsed. The line was commissioned in the year 2019 and the line length is 207.2 km. The reported probable cause of failure is heavy rain, wind storm &

lightning. The line was designed for Wind Zone 4. Chief Engineer (PSE&TD), CEA suggested to coordinate with IMD for wind speed data.

5. **400 kV Imphal – Thoubal transmission line:** The Representative of **MSPCL** presented the failures of 400 kV Imphal – Thoubal transmission line having failure of 5 nos. of towers consisting of 3 nos. of suspension type towers and 2 nos. of tension type towers. The line was commissioned in the year 2021 and the line length is 45.11 km. The reported probable cause of failure is cyclonic storm. As all required details were not furnished, Chief Engineer (PSE&TD), CEA requested MSPCL to submit all the requisite data/ details so that cause of failure can be analyzed properly.
6. **220 kV D/C Sohna Road -Rangala Rajpur line:** The Representative of **HVPNL** presented the failures of 220 kV D/C Sohna Road -Rangala Rajpur line in which 3 nos. of suspension type towers got collapsed. The line was commissioned in the year 2015 and the line length is 69.316 km. The reported probable cause of failure is Heavy whirl wind storm of high Intensity and its cascaded effect.

Chief Engineer (PSE&TD), CEA inquired about the patrolling frequency in the theft prone line in response of which the Representative of HVPNL said that they are following 15 days/ 1 month patrolling frequency depending on the criticality of the tower location. He further added to manage/ avoid the theft, local people are being involved in the patrolling.

7. The Representative of **MPPTCL** presented the failures of 3 nos. of transmission Line having failure of 11 nos. of towers consisting of 10 nos. of suspension type towers and 1 no. of suspension type tower. The transmission line wise deliberations are as under:
  - (i) **220 kV Rewa (220 kV) -Rewa (RUMSP) ckt-I & ckt-II & 220 kV Sidhi (RUMSP) ckt-I & ckt-II:** In 220 kV Rewa (220 kV) -Rewa (RUMSP) ckt-I & ckt-II & 220 kV Sidhi (RUMSP) ckt-I & ckt-II, 1 no. of multi circuit suspension type tower got collapsed. The line was commissioned in the year 2022 and the line length is 32.33 km. The reported probable cause of failure is heavy wind and thunder across the line. Missing cleat and plate are noted as main causes of tower collapse. The Representative of MPPTCL further added that during patrolling it was found that the HTLS conductor was also stolen for 3 span around 900 meters. Therefore, to avoid further theft, running welding on stub jointing cleat & plate and first section jointing cleat & plate has been done from location no 206 to 207 falling under the theft prone area.
  - (ii) **400 kV DCDS Malwa TPH (SSTPH)-Pithampur Ckt. I & II line:** In 400 kV DCDS Malwa TPH (SSTPH)-Pithampur Ckt. I & II line, 9 nos. of towers got collapsed out of which 8 nos. are of

suspension type tower and 1 no is of tension type tower. The line was commissioned in the year 2013 and the line length is 136 km. The reported probable cause of failure is cyclonic storm in local area. The Representative of MPPTCL further informed that an internal committee was constituted to investigate the cause of failure of structures which opined that structure failure was due to heavy cyclonic circulation in the area. He further added that towers also collapsed in 2019, 2020 & 2021 and to avoid reoccurrence of the same, tower structures have been redesigned as per IS 802:1995. Director (PSE&TD), CEA suggested to check the strength of tower as per IS 802:2015.

- (iii) **220 kV Satna (220 kV) - Rewa & 220 kV Satna – Manpur (Adani) line:** In 220 kV Satna (220 kV) - Rewa & 220 kV Satna – Manpur (Adani) line, 1 no. of suspension type tower got collapsed. The line was commissioned in the year 1991 and the line length is 48.48 km. The reported probable cause of failure is heavy wind and thunder across the line. The Representative of MPPTCL informed that their internal committee opined that structure failure was due to heavy cyclonic circulation in the area. Director (PSE&TD), CEA suggested to check the design and strength of tower as per IS 802:2015.

8. **220 kV Kashmere Gate-South of Wazirabad line:** The Representative of DTL presented their failures of 220 kV Kashmere Gate-South of Wazirabad line in which 1 no. of suspension type towers got collapsed. The line was commissioned in the year 1992 and the line length is 5.34 km. The reported probable cause of failure is localized whirl wind. The Representative of DTL informed that previous failure in the same transmission line occurred in July, 2014. The in-house investigation of DTL opined that the fault occurred due to tilting of top of tower no. 15 of the 220KV D/C South of Wazirabad - Kashmere Gate line. Circuit –I was tripped due to fault sensed by relay in R-phase. Breaker was tripped within 52 ms and subsequently breaker auto reclosure was initiated. After 82 ms relay sensed fault in B-phase, breaker tripped off in 51ms and circuit was isolated for patrolling. Circuit-II was tripped due to fault sensed by relay in Y-phase and Breaker tripped within 51ms. Director (PSE&TD), CEA suggested to check the design and strength of tower as per IS 802:2015.

9. The Representative of DVC presented the failures of 2 nos. of transmission lines having failure of 3 nos. of suspension type towers. The transmission line wise deliberations are as under:

- (i) **220 kV D/C Line 203 & 204 (CTPS-DHANBAD):** In 220 kV D/C Line 203 & 204 (CTPS-DHANBAD), 2 nos. of suspension type towers failed. The line was commissioned in the year 1997 and the line length is 45 km and the line was designed for Wind Zone 5. The reported probable cause of failure is unprecedented high wind at the time of incident. The representative of DVC informed that the high intensity wind followed by rain fall and the twisting effect of wind led to collapse of 2 nos. (DA+3) suspension type towers at location nos. 34 and 35, perpendicular to line. The high wind speed with wheeling effect of wind

caused collapse of tower no 35 first followed by tower no 34 subsequently. As a remedial action, new (DC+11) angle tower erected at location no 34 and (S+6) angle tower erected at location no-35. Drone patrolling of transmission line with visual and thermal sensors has also been introduced. Director (PSE&TD), CEA suggested that the restored tower must be checked as per the latest standards.

- (ii) **400 kV D/C RTPS-Ranchi line Ckt 2 & 3:** In 400 kV L#407, 408 (400KV D/C RTPS-Ranchi T/L) Ckt 2,3, 1 no. of suspension type tower got collapsed. The line was commissioned in the year 2017 and the line length is 155.16 km and the line was designed for Wind Zone 4. The reported probable cause of failure is unprecedented high wind at the time of twisting and the twisting has been occurred perpendicular of the line as found by the Committee. The representative of DVC stated that it was observed that the Location No.-195 is situated on a valley like terrain and there are no obstructions in the near vicinity which may lead to the wind tunneling effect. It is also apprehended that there might be some tower member/ bolts missing / theft by miscreant which may be one of the reasons for tower failure. As a remedial action new tower has been erected by using the existing foundation by stub splicing of all the four main legs and both the lines were charged on 26.6.2024. Tensile test and salt spray exposure of Tower material carried out, test results are found to be in-order. Drone patrolling of transmission line with visual & thermal sensors was introduced. Director (PSE&TD), CEA suggested that the restored tower must be checked as per the latest standards.

**10. GETCO, MSETCL, APTRANSCO, NTPC have reported their respective EHV Transmission Line tower failure cases but their representative have not attended the meeting. Standing Committee members from Regional Power Committees (NRPC, SRPC, WRPC, ERPC and NERPC), Department of Civil Engineering, Delhi Technological University have not attended the meeting.**

11. In this regard, the Committee discussed about ways & means of obtaining wind speed data pertaining to tower failure incidents, as it would be helpful in verifying the effectiveness of the tower design, and enable utilities to improve the same. It was noted that a proposal of installing wind sensors at appropriate locations was discussed in the last meeting, wherein it was suggested to the utilities to go for the same on pilot basis, and take the help of India Meteorological Department (IMD) on the matter. The Representative of IMD emphasized the importance of capturing accurate and comprehensive wind data for better understanding and assessment of localized storm phenomena and whirlwinds and highlighted that if additional wind data could be collected from interior tower locations operated by various power utilities, it would significantly enhance the ability to analyze wind patterns.

In this regard, it was noted that already IMD has put in place a network of wind sensors at some 700 locations spread across India, each of which would be able to capture related wind parameters including speed within a radius of 10 km, and a brief demo was given by IMD to Committee members. After discussions, it was agreed that all transmission utilities make use of this information to get specific wind speed details pertaining to their respective events by getting in touch with concerned IMD Department Officials. The website for the same is noted as [aws.imd.gov.in](https://aws.imd.gov.in)

In this connection, it was also noted that certain states (agriculture/ irrigation departments) have installed a web of wind sensors for capturing weather related information including wind speed. It was also noted that wind related information would also be generally available with Airports and Wind Farms.

It was requested that Utilities put efforts to obtain relevant wind details from the above sources for properly analysing their respective tower failure incidents.

12. It was noted by the Committee that the wind map was last revised by SERC in 2016 using the 2009 wind data, and the same incorporated into the National Building Code (NBC) by BIS. However, the revised wind map is yet to be included in IS 875.

In this connection, it was noted the current wind patterns prevailing over various areas have changed in the past few years due to various reasons including climate change events, and there is a need to revise the above wind zone map of India prepared by SERC, and incorporated in NBC in 2016.

In light of above discussion pertaining to availability of wind data from multitude of IMD sensors (700 plus locations spread across India), SERC has been requested to take up the exercise of revising existing wind zones appropriately. IMD has also been requested to render suitable help in this regard by providing relevant data to them.

## 4. Statistics and Analysis of the EHV Transmission Line Tower failure

### 4.1 Failure incidence intimation and report submission statistics

| SN | Category | Number of Failures | Number of Utilities | Remarks |
|----|----------|--------------------|---------------------|---------|
|----|----------|--------------------|---------------------|---------|

|   |                                                                                                         |    |   |                                                                                                                                                      |
|---|---------------------------------------------------------------------------------------------------------|----|---|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Utilities intimated within 48 hrs on their own                                                          | 10 | 4 | PGCIL, ADANI Power, DVC (for 400KV D/C RTPS-Ranchi T/L) and RVPN (for 400 KV D/C Bhadla-Jodhpur-Merta Line) had submitted the failure cases on time. |
| 2 | Utilities intimated after 48 hrs on their own                                                           | 4  | 4 | APTRANSCO (for 220KV Pendurthi -Upper Sileru line), HVPNL, DTL, DVC intimated within one month on their own.                                         |
| 3 | Utilities submitted Detailed Report in One Month on their own                                           | 14 | 8 | PGCIL, ADANI Power, APTRANSCO (for 220KV Pendurthi -Upper Sileru line), HVPNL, DTL had submitted the Report on time                                  |
| 4 | Utilities submitted Detailed Report after One Month but before CEA letter dated 11.03.2025 on their own | 7  | 2 | MSETCL, MPPTCL                                                                                                                                       |
| 5 | Utilities submitted Detailed Report only after CEA letter dated 11.03.2025.                             | 6  | 4 | GETCO, NTPC, MSPCL, RVPN (for 220 KV MIA-BTPS LINE) had submitted the report after CEA letter dated 11.03.2025.                                      |
| 6 | Utilities not submitted Detailed Report even after CEA letter                                           | 1  | 1 | APTRANSCO (for 220 kv VSS - Parawada)                                                                                                                |

## 4.2 General Statistics of Reported EHV Transmission Line Tower Failures

- a) Failure of 76 Nos. of EHV Transmission Line Towers in 28 Nos. Transmission Lines of voltage class of 220 kV, 400 kV and 765 kV AC have been reported to CEA during the period of January, 2024 to December, 2024. The total 28 Nos. of EHV Transmission Lines failure are mentioned in the Table 1 given below:

**Table 1: Details of failure of EHV Transmission Lines**

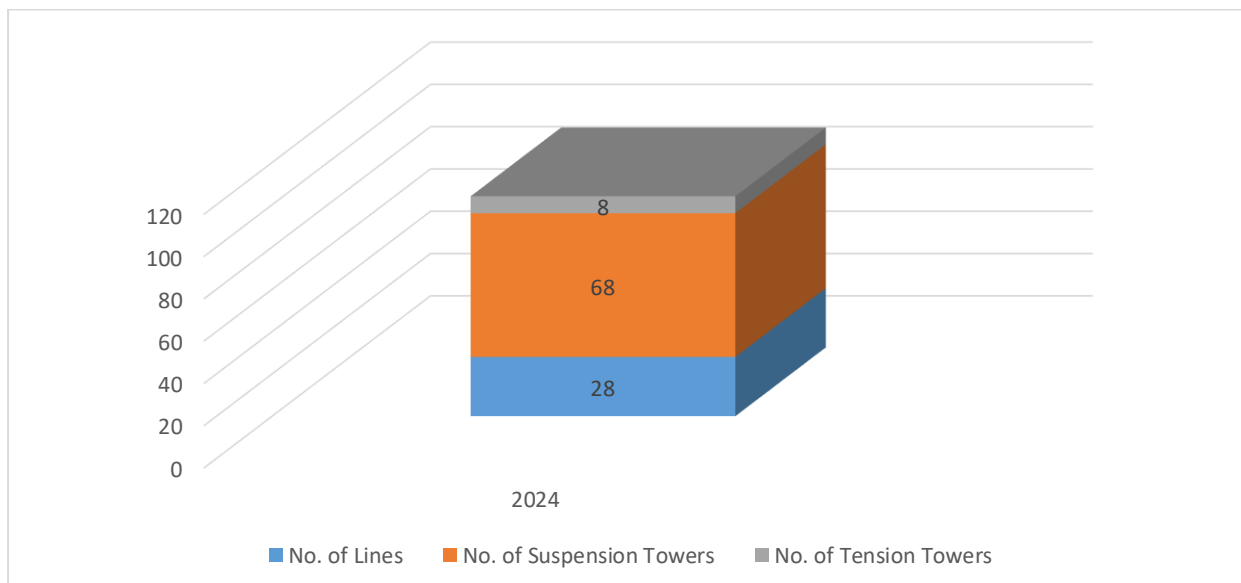
| S.N. | Name of the Transmission Line                                                                   | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor                 |
|------|-------------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|---------------------------|
|      |                                                                                                 |                 |                 |                       |           | Suspension           | Tension | Total |                           |
| 1.   | 400 kV D/C Kishenpur-New Wanpoh III & IV                                                        | PGCIL           | 19.02.2024      | 29.07.2017            | 2         | 0                    | 1       | 1     | 400 kV Twin MOOSE ACSR    |
| 2.   | 400 kV D/C Silchar-Imphal                                                                       | PGCIL           | 17.04.2024      | 21.05.2015            | 6         | 0                    | 1       | 1     | 400 kV Twin MOOSE ACSR    |
| 3.   | 400 kV D/C Gaya-Koderma Transmission Line                                                       | PGCIL           | 23.04.2024      | 2014                  | 2         | 7                    | 0       | 7     | 400 kV Quad Moose ACSR    |
| 4.   | 400 kV D/C Kishenpur-New Wanpoh III & IV                                                        | PGCIL           | 26.04.2024      | 29.07.2017            | 2         | 0                    | 3       | 3     | 400 kV Twin MOOSE ACSR    |
| 5.   | 400kV D/C Abdullapur-Bawana / Deepalpur-Bawana                                                  | PGCIL           | 04.06.2024      | 01.01.2000            | 4         | 2                    | 0       | 2     | 400 kV Tripple Snowbird   |
| 6.   | 765 kV S/C Gwalior-Agra #1                                                                      | PGCIL           | 12.09.2024      | 01.04.2007            | 4         | 1                    | 0       | 1     | 765 kV Quad Bersimis ACSR |
| 7.   | 765kV D/C BILASPUR – RAJNANDGAON TRANSMISSION LINE - Circuit 1 & 2 (SIPAT TRANSMISSION LIMITED) | ADANI           | 10.05.2024      | 2019                  | 2         | 4                    | 0       | 4     | 765 kV Hexa Zebra         |
| 8.   | 765 KV S/C AKOLA (2) – EKTUNI LINE – 2 (MEGPTCL)                                                | ADANI           | 26.05.2024      | 2016                  | 2         | 4                    | 0       | 4     | 765 kV Quad Bersimis ACSR |
| 9.   | 220 KV MIA-BTPS LINE                                                                            | RVPN            | 25.03.2024      | 1976                  | NA        | 2                    | 0       | 2     | 220 kV Single Zebra       |
| 10.  | 400 KV D/C Bhadla-Jodhpur-Merta Line                                                            | RVPN            | 05.07.2024      | 01.09.2019            | 4         | 5                    | 0       | 5     | 400 kV Twin MOOSE ACSR    |



|     |                                                                                         |           |            |            |              |   |   |   |                                                     |
|-----|-----------------------------------------------------------------------------------------|-----------|------------|------------|--------------|---|---|---|-----------------------------------------------------|
| 11. | 400 kV Imphal – Thoubal Line                                                            | MSPCL     | 24.04.2024 | 15.03.2021 | Not Provided | 3 | 2 | 5 | 400 kV Moose ACSR                                   |
| 12. | 220kV VSS - Parawada                                                                    | APTRANSCO | 01.06.2024 | -          | Not Provided | 1 | 0 | 1 | -                                                   |
| 13. | 220KV Pendurthi - Upper Sileru line                                                     | APTRANSCO | 03.10.2024 | 1968       | 5            | 1 | 0 | 1 | 220 kV Deer ACSR                                    |
| 14. | 220 kV Khaperkheda-Butibori I Ckt & 220 kV Khaperkheda- Butibori III Ckt                | MSETCL    | 22.04.2024 | 28.10.1988 | 2            | 1 | 0 | 1 | 220 kV Zebra ACSR                                   |
| 15. | 400 kV CHD-II-Warora D/C Line                                                           | MSETCL    | 22.04.2024 | 16.01.2014 | 3            | 2 | 0 | 2 | 400 kV Quad Moose AAAC                              |
| 16. | 220 kV Lamboti - Pandharpur Line & 220 kV Lamboti - Karkamb Line                        | MSETCL    | 26.05.2024 | 1980       | 1            | 6 | 0 | 6 | 220 kV Zebra ACSR                                   |
| 17. | 220kV Girwali-Parli Ckt-2 & 220kV Parli-PGCIL Ckt-2 DC line                             | MSETCL    | 26.05.2024 | 25.09.1977 | 2            | 6 | 0 | 6 | 220 kV Zebra ACSR                                   |
| 18. | 220 kV D/C Sohna Road -Rangala Rajpurline                                               | HVPNL     | 01.06.2024 | 2015       | 4            | 3 | 0 | 3 | 220 kV Moose ACSR                                   |
| 19. | 220kV Nanikhakhar-Nakhatrana D/C line                                                   | GETCO     | 09.01.2024 | 30.12.1997 | 5            | 1 | 0 | 1 | 220 kV Zebra ACSR                                   |
| 20. | 220 kV Akri Nakhatrana/Akri Bhachunda Line                                              | GETCO     | 01.07.2024 | 18.02.2004 | 5            | 3 | 0 | 3 | 220 kV Zebra ACSR                                   |
| 21. | 220 kV Tappar- Vondh line                                                               | GETCO     | 06.10.2024 | 28.06.2013 | 5            | 1 | 0 | 1 | 220 kV Zebra ACSR                                   |
| 22. | 220kV Rewa (220 kV) - Rewa (RUMSP) ckt-I & ckt-II & 220 kV Sidhi (RUMSP) ckt-I & ckt-II | MPPTCL    | 19.05.2024 | 23.09.2022 | Not Provided | 1 | 0 | 1 | 220 kV Single Zebra HTLS / 220 kV Single ACSR Zebra |

|     |                                                                  |        |            |            |              |    |   |    |                          |
|-----|------------------------------------------------------------------|--------|------------|------------|--------------|----|---|----|--------------------------|
| 23. | 400kV DCDS Malwa TPH (SSTPH)- Pithampur Ckt. I & II line         | MPPTCL | 26.05.2024 | 2013       | 3            | 8  | 1 | 9  | 400 kV Twin Moose ACSR   |
| 24. | 220kV Satna (220 kv) - Rewa & 220 kv Satna – Manpur (Adani) line | MPPTCL | 17.06.2024 | 06.04.1991 | Not Provided | 1  | 0 | 1  | 220 kV Single Zebra ACSR |
| 25. | 220 kV Kashmere Gate-South of Wazirabad                          | DTL    | 29.12.2024 | 1992       | 4            | 1  | 0 | 1  | 220 kV Zebra ACSR        |
| 26. | 220 kV D/C Line 203 & 204 (CTPS-DHANBAD)                         | DVC    | 08.05.2024 | 1997       | 5            | 2  | 0 | 2  | 220 kV Single Zebra ACSR |
| 27. | 400 kV L#407, 408 (400KV D/C RTPS-Ranchi T/L) Ckt 2, 3           | DVC    | 30.05.2024 | 30.08.2017 | 4            | 1  | 0 | 1  | 400 kV Quad Moose ACSR   |
| 28. | 400 kV Dadri-Harsh Vihar Ckt-1&2                                 | NTPC   | 05.06.2024 | 2011-2012  | 4            | 1  | 0 | 1  | 400 kV Twin Moose ACSR   |
| 29. | Total                                                            |        |            |            |              | 68 | 8 | 76 |                          |

- b) The total number of incidences of failures of EHV Transmission Line Towers, and the Nos. of affected Tension type and Suspension type towers that have been reported to CEA for the period of January, 2024 to December, 2024 are indicated in the Fig. 1 given below.



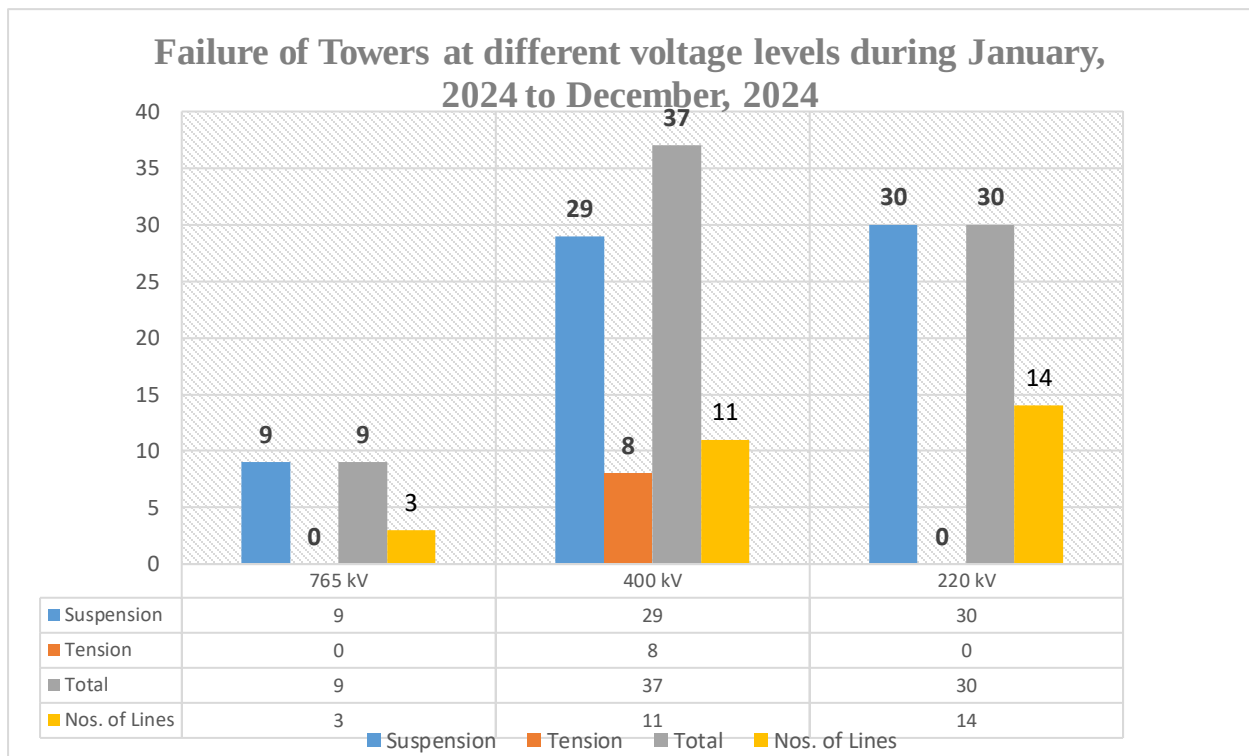
**Fig. 1**

- c) The number of failed Suspension and Tension type towers at various voltage levels, reported for the period of January, 2024 to December, 2024 are indicated in Table-2 below:

**Table 2: Voltage wise Tower failure**

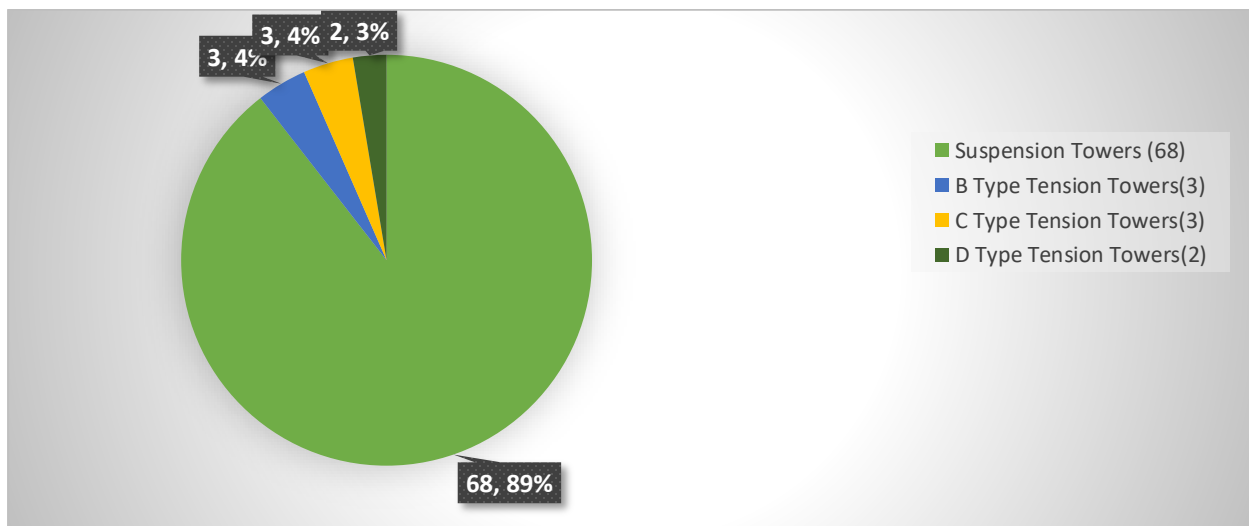
| Voltage Level | Utility   | No of affected line | No of Tower failed |               |   |   |   | Total no of Tower |
|---------------|-----------|---------------------|--------------------|---------------|---|---|---|-------------------|
|               |           |                     | Suspension tower   | Tension Tower |   |   |   |                   |
|               |           |                     |                    | A             | B | C | D |                   |
| 765 kV        | PGCIL     | 1                   | 1                  | 0             | 0 | 0 | 0 | 1                 |
|               | ADANI     | 2                   | 8                  | 0             | 0 | 0 | 0 | 8                 |
|               | Total     | 3                   | 9                  | 0             | 0 | 0 | 0 | 9                 |
| 400 kV        | PGCIL     | 5                   | 9                  | 2             | 2 | 1 | 5 | 14                |
|               | RVPN      | 1                   | 5                  | 0             | 0 | 0 | 0 | 5                 |
|               | MSPCL     | 1                   | 3                  | 1             | 1 | 0 | 2 | 5                 |
|               | MSETCL    | 1                   | 2                  | 0             | 0 | 0 | 0 | 2                 |
|               | MPPTCL    | 1                   | 8                  | 0             | 0 | 1 | 1 | 9                 |
|               | DVC       | 1                   | 1                  | 0             | 0 | 0 | 0 | 1                 |
|               | NTPC      | 1                   | 1                  | 0             | 0 | 0 | 0 | 1                 |
|               | Total     | 11                  | 29                 | 3             | 3 | 2 | 8 | 37                |
| 220 kV        | RVPN      | 1                   | 2                  | 0             | 0 | 0 | 0 | 2                 |
|               | APTRANSCO | 2                   | 2                  | 0             | 0 | 0 | 0 | 2                 |
|               | MSETCL    | 3                   | 13                 | 0             | 0 | 0 | 0 | 13                |
|               | HVPN      | 1                   | 3                  | 0             | 0 | 0 | 0 | 3                 |
|               | GETCO     | 3                   | 5                  | 0             | 0 | 0 | 0 | 5                 |
|               | MPPTCL    | 2                   | 2                  | 0             | 0 | 0 | 0 | 2                 |
|               | DTL       | 1                   | 1                  | 0             | 0 | 0 | 0 | 1                 |
|               | DVC       | 1                   | 2                  | 0             | 0 | 0 | 0 | 2                 |
|               | Total     | 14                  | 30                 | 0             | 0 | 0 | 0 | 30                |
| Total         |           | 28                  | 68                 | 3             | 3 | 2 | 8 | 76                |

- d) It can be seen from the below **Fig. 2** that at 765 kV Voltage level, 9 nos of Suspension type tower have failed in 3 nos. of Transmission Line, at 400 kV Voltage level 29 nos. of Suspension type tower and 8 nos. of Tension type towers have failed in 11 nos. of Transmission Line, and at 220 kV Voltage level 30 nos. of Suspension type tower have failed in 14 nos. of Transmission Line.



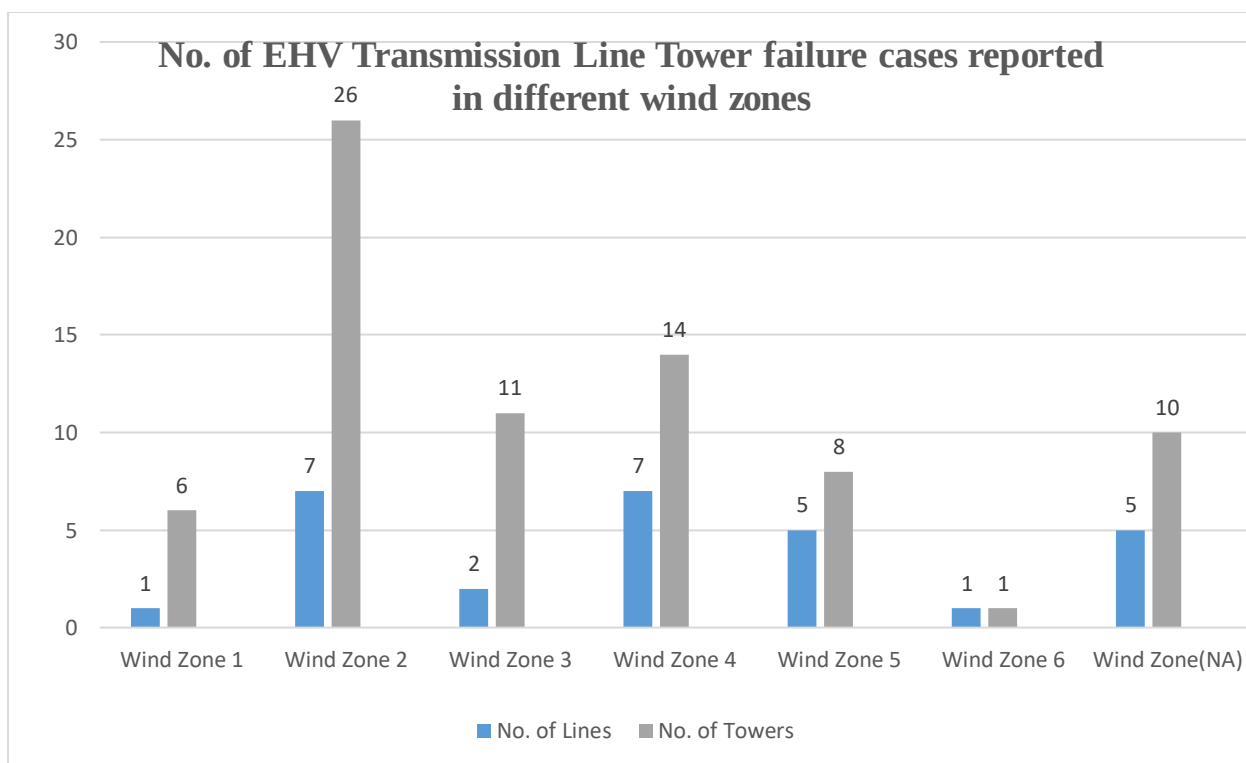
**Fig. 2**

- e) It can be seen from the below **Fig. 3** that out of total 76 nos. of EHV Line Tower failure, 68 nos. are of Suspension type tower leading to its share of 89.5 % of total towers failed and 8 nos. are of Tension type towers leading to its share of 10.5 % of total towers failed. Out of total 8 nos. of Tension Type tower, 3 nos. are of Type B, 3 nos are of Type C and 2 nos are of Type D Tension type tower.



**Fig. 3**

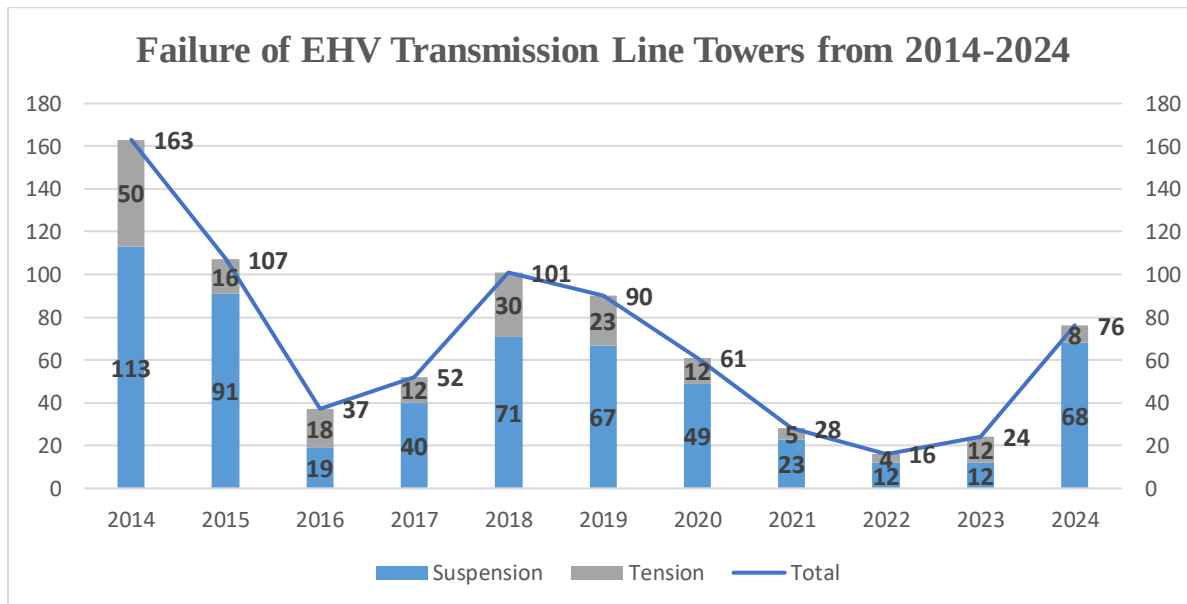
- f) It has been observed that the failure rate of Suspension type tower is much higher in comparison to Tension type tower. This may be because in normal terrain, generally, the nos. of Suspension type tower in any particular line is much higher than that of Tension type tower. Further, the Suspension type towers are not designed to take horizontal forces in the longitudinal direction and hence the failures of one suspension type tower causes secondary failure of adjacent Suspension towers due to the pulling force of conductors. In view of above, the loading criteria for the Suspension type towers have been made more stringent and the longitudinal and transverse force acting on Suspension type towers under security condition has been increased in revised IS 802: 2015.
- g) The wind map of India was divided into three wind pressure zones that is light, medium & heavy, before the revision of IS 802 in 1995. In the third revision of IS 802: 1995, 6 wind zones were specified dividing various regions on the basis of 3-second wind gust speed. The no. of transmission lines and towers, failed during the period from January, 2024 to December, 2024 and designed according to various wind zones is given in Fig. 4 below. It can be seen that the maximum No. of failure of towers have occurred for transmission lines which were designed for Wind Zone 2 and 4. It may be noted that maximum area of India is covered under the wind zones 2 and 4.



**Fig. 4**

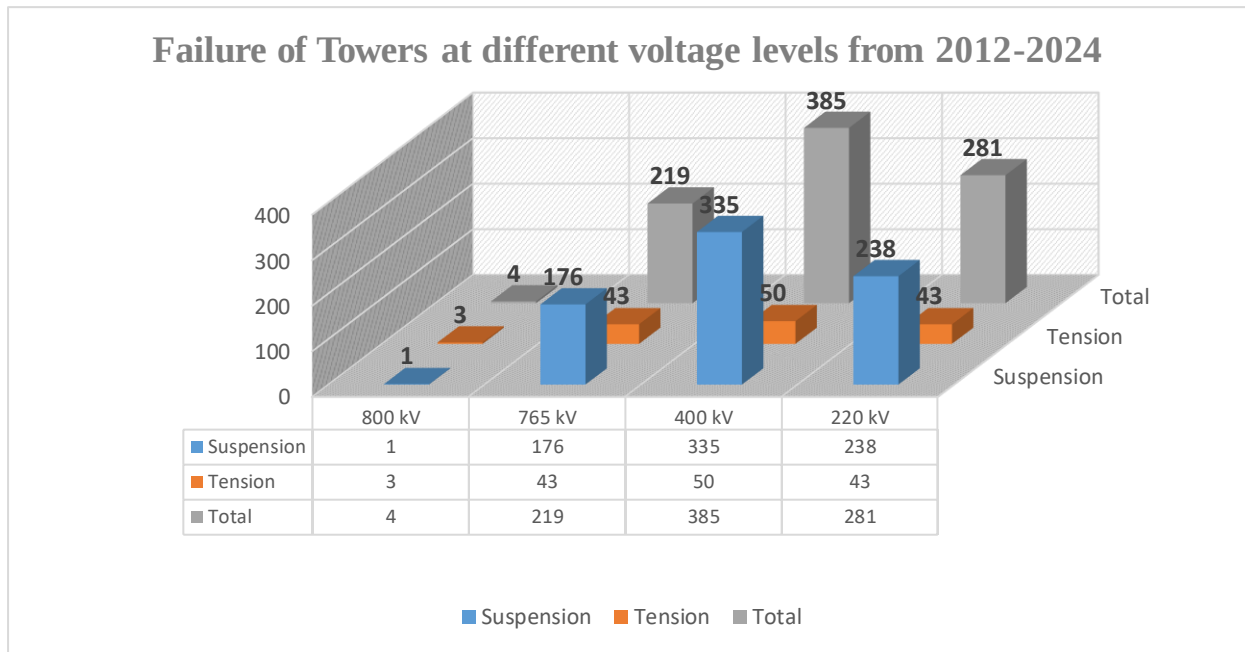
### 4.3 Insights into Tower Failure Incidents during Past Years

- a) The details of previous EHV Transmission Line Tower failure incidents which were reported to CEA and have been discussed in the past Standing Committee meetings from the year 2014 onwards have been analyzed by CEA and the graph depicting the failures of EHV Transmission Line towers occurred during past years (2014-2024) that have been discussed in the previous Standing committee meetings are shown below in **Fig. 5**. The maximum No. of failures, i.e., 163 cases of tower failures occurred during year 2014. As has been observed in the previous Standing Committee meetings, the failure rate of suspension towers is much higher in comparison to tension towers. This may be because of the cascading effect of failure of suspension type towers i.e. secondary failure of adjacent suspension towers due to the pulling force of conductors which have been developed due to failure of another tower.



**Fig. 5**

- b) The graph depicting the failures of towers at various voltage levels that have occurred in past years (2012-2024) and intimated to CEA which have been discussed in the Standing committee meetings are shown below in **Fig. 6**. It may be observed that towers of 400 kV voltage level have maximum incidents of failure. It may be noted that the mandate of the Standing Committee is to investigate failure of towers of 220 kV and above voltage class transmission line and the graph shows the details of only those transmission line failures which have been intimated to CEA.



**Fig. 6**

## 5. Observations of the Committee

a) The type of failures of EHV Transmission Line Towers of various voltage levels can be broadly classified as under:

- Deformation in legs of towers and cage portion of bottom cross arm level.
- Buckling at stub level leading to complete collapse of towers with/without damage to tower foundation.
- Buckling above 1<sup>st</sup> panel (normal tower) level with/ without damage to tower foundation.
- Buckling from bottom cross arm level or top cross arm level or peak broken without any damage to lower portion of the tower and foundation.
- Damage to foundation as well as to tower structure due to increased water level and additional force due to water flow/velocity in the river/soil erosion and inadequate protection to foundation of towers.
- Shearing of stubs of leg members of towers.

b) The main cause of tower failures is attributed to high intensity wind as reported by the transmission utilities, however the utilities failed to produce wind data in many cases of EHV Transmission Line Tower failures which could substantiate their reasoning. The transmission utilities are unable to produce the actual wind speed data on the day of failures due to non-availability of wind speed data at the failure location. The standing committee observed that wherever reporting of tower failure is due to wind, the utility needs to get the wind data for the area from the **IMD observatory/ nearby Airport** which would serve as representative wind speed prevailing in that area at the time of failure. It was agreed that the high wind velocity during storm

*Report of the Standing Committee of Experts on Failure of EHV Transmission Line Towers (January, 2024 – December, 2024)*

and local condition of whirl wind might have exceeded the design wind speed for which the tower is designed; however this needs to be verified. Assistance of IMD & other agencies involved in metrological field may be taken by the affected utilities in this regard and utilities may request for sharing of the wind data obtained from Observatory/Satellite/ Radar.

- c) The structural integrity of transmission towers depends on many factors including adequacy of technical standard/ stipulated codal requirement considered for designing the transmission tower, quality of material grade used in tower body, Construction methodology, workmanship and erection practices, Operations & Maintenance practices of the transmission utilities etc.
- d) Over the years, Indian Standards for design of transmission line tower has undergone changes. As revision of codal provisions is a continuous process, the changes are to be implemented prospectively. **Strengthening of towers of existing transmission lines due to change in the codal provisions could be decided on case to case basis, if repeated failures are observed in a particular line. The Committee observed that the tower erected after restoration should be based on latest standards. And Spare towers which the Utilities procure also should conform to latest standards.**

## 6. Recommendations and Remedial Measures suggested by the Committee

The recommendations and remedial measures suggested by the Committee after detailed deliberations are given under:

- a) Utilities shall intimate and submit tower failure incidents in compliance with relevant regulatory provisions well in time so that site visits can be undertaken wherever required.
- b) After every failure, the concerned utility needs to submit the actual wind velocity prevailed in the affected area so that the Investigating Team of Standing Committee could get reference wind speed prevailed over that area. In this matter, the respective utility may seek the help of IMD/ nearest Airport to estimate the wind speed in affected area based on data obtained from observatory/ Satellite/Radar.
- c) Utilities shall take up implementation of Digitization of Spares and Inventory Management of transmission system assets using suitable software like SAP.
- d) Utilities should undertake regular O&M of their transmission lines to ensure that they are maintained in healthy condition, and no RoW encroachment and unwarranted theft events take place. In this all Utilities have been requested to furnish a brief on the operation and maintenance practices adopted in their respective networks.



- e) Utilities have been requested to get in touch concerned IMD Officials, and make use of wind related data from IMD's network of wind sensors for analysing their respective tower failure events.
- f) In view of the need to revise prevailing wind zones, SERC has been requested to take up the exercise of revising the same in consultation with IMD. IMD has also been requested to render suitable help by providing access to relevant wind data to SERC in this regard.
- g) The towers which were designed based on old standards should be checked and strengthened as per latest standards.
- h) The drag coefficient considered for tower design shall be as follows –

| As per IS 802:1995 |                  |
|--------------------|------------------|
| Solidity ratio     | Drag Coefficient |
| Up to 0.05         | 3.6              |
| 0.1                | 3.4              |
| 0.2                | 2.9              |
| 0.3                | 2.5              |
| 0.4                | 2.2              |
| 0.5 & above        | 2.0              |

- i) Due to climatic change, incidents of high winds are increasing. Transmission Utilities need to take proactive measures such as **increased line patrolling**, immediate replacement of missing members/bolts. Various deficiencies such as missing members, missing bolts, bent members, incorrect attachment of cross arm, chimney covered with soil, rusted stub/members etc. has been observed during the failure of site visit of various transmission towers of different utilities. These deficiencies may be attributed to poor workmanship, erection deficiency, O&M issues etc. Utilities shall take necessary precautions and carry out proper maintenance of their lines so as to avoid failure of towers due to such deficiencies.
- j) In case of towers in critical locations with regular high speed wind phenomenon, redundant members of tower should be designed with actual loads and non-linear analysis of tower should be carried out. Modern technique/methods should be adopted for erection and stringing of towers.
- k) Pile type foundation shall be used for towers located in river or creek bed or on bank of river having scourable strata or in areas where river flow or change in river course is anticipated, based on detailed soil investigation and previous years' maximum flood discharge of the river, maximum velocity of water, highest flood level, scour depth and anticipated change in courser of



river based on river morphology data of at least past 20 years to ensure availability and reliability of the transmission line.

- l) The transmission towers erected near river banks should be frequently patrolled and assessment based on history should be made to anticipate the change in course of river and necessary protection should be provided to towers to avoid its damage during such incident.
- m) Proper coordination should be established with the dam authorities in areas where transmission towers are located near dams and are susceptible to flooding.
- n) In case of damage of foundation of towers, the foundation design is required to be examined.
- o) The material test report of failed towers should be examined to ascertain the quality of the material.
- p) Utilities shall ensure that casting of chimneys and placement of stubs are done as per approved drawings. Due to improper erection, residual stresses are developed in the towers which cause failure of towers.
- q) Committee suggested to clear the encroachment in the ROW of the line. Committee advised that utilities should improve their erection, patrolling and operation and maintenance practices.
- r) Regular patrolling of the lines is required for smooth and trouble free operation of line. During patrolling, any unauthorized construction/use/ storage under and around the towers should also be checked and if such activity is observed, local administrative authority should be immediately informed for assistance and necessary action. In case of failure due to theft/misconduct of miscreants, accidents of vehicles in the tower structure etc., Committee recommended to submit a FIR copy.



## Annexure-I: List of Participants

### **CEA**

1. Sh. N.R.L.K. Prasad, Chief Engineer (PSE&TD)
2. Sh. Bhanwar Singh Meena, Director (PSE&TD)
3. Sh. Pankaj Kumar Sangwan, Dy. Director (PSE&TD)
4. Smt. Jyoti Singh, Dy. Director (PSE&TD)
5. Sh. Amrendra Pratap Singh, Assistant Director (PSE&TD)
6. Smt. Rashmi, Assistant Director (PSE&TD)

### **CPRI**

1. Sh. Vijaya Kumar

### **IMD**

1. Sh. Trisanu Banik, Sc-D

### **POWERGRID**

1. Sh. N. K. Sinha, Sr. DGM
2. Sh. Amit Kumar, Sr. DGM
3. Sh. Vivek Sunderiyal, DGM
4. Sh. Rakesh Kumar Gupta, DGM

### **MPPTCL**

1. Sh. Sandeep kumar Gaikwad, Chief Engineer

### **MSPCL**

1. Sh. Davidkumar Singh, Dy. General Manager
2. Sh. Priyananda Singh, Executive Director

### **RVPNL**

1. Sh. S.B. Arora, Ex. Engg.
2. Sh. Mahipal Singh Yadav, S.E.
3. Sh. Ramniwas Kadhala, S.E.



**UPPTCL**

1. Sh. Mohd. Saud, Executive Engineer
2. Sh. Mohd. Shahid, Executive Engineer
3. Sh. Mohd. Reja Ahmad, Executive Engineer

**HVPNL**

1. Sh.Hans Raj, Executive Engineer

**DVC**

1. Sh. Sujeet Kumar, Dy.General Manager
2. Sh. Bipin Kumar Jha, Sr. Manager

**CSIR-SERC CHENNAI**

1. Dr.R.P. Rokade, Sr.Principal Scientist
2. Sh. M.B.Anoop, Scientist

**DTL**

1. Sh. Abhishek Kumar, Sr.Manager

**BBMB DELHI.**

1. Sh. Aman Dahiya, Sr.Executive Manager
2. Mrs. Sakshi Jain

**ADANI ENERGY SOLUTION LTD.**

1. Sh. Keyur Vadher, TL Manager



## **Annexure-II: Detailed Information of EHV Transmission Line Tower Failure Cases as Reported by Various Transmission Utilities**



## 1. POWERGRID

The following Transmission Lines Towers of POWERGRID had failed during January, 2024 to December, 2024:

| Sl. No. | Name of the Transmission Line                  | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor                 |
|---------|------------------------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|---------------------------|
|         |                                                |                 |                 |                       |           | Suspension           | Tension | Total |                           |
| 1.1     | 400 kV D/C Kishenpur-New Wanpoh III & IV       | PGCIL           | 19.02.2024      | 29.07.2017            | 2         | 0                    | 1       | 1     | 400 kV Twin MOOSE ACSR    |
| 1.2     | 400 kV D/C Silchar-Imphal                      | PGCIL           | 17.04.2024      | 21.05.2015            | 6         | 0                    | 1       | 1     | 400 kV Twin MOOSE ACSR    |
| 1.3     | 400 kV D/C Gaya- Koderma Transmission Line     | PGCIL           | 23.04.2024      | 2014                  | 2         | 7                    | 0       | 7     | 400 kV Quad Moose ACSR    |
| 1.4     | 400 kV D/C Kishenpur-New Wanpoh III & IV       | PGCIL           | 26.04.2024      | 29.07.2017            | 2         | 0                    | 3       | 3     | 400 kV Twin MOOSE ACSR    |
| 1.5     | 400kV D/C Abdullapur-Bawana / Deepalpur-Bawana | PGCIL           | 04.06.2024      | 01.01.2000            | 4         | 2                    | 0       | 2     | 400 kV Tripple Snowbird   |
| 1.6     | 765 kV S/C Gwalior-Agra #1                     | PGCIL           | 12.09.2024      | 01.04.2007            | 4         | 1                    | 0       | 1     | 765 kV Quad Bersimis ACSR |

**DETAILS IN RESPECT OF EACH TRANSMISSION LINE****1.1 400 kV D/C Kishenpur-New Wanpoh III & IV**

|     |                                                                                                                                                                                                                                   |                                                                                                                 |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                     | 400 kV D/C Kishenpur-New Wanpoh III & IV                                                                        |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                                 | 12:12 hrs/19.02.2024                                                                                            |
| 3.  | Length of line (km):                                                                                                                                                                                                              | 135.015 kms                                                                                                     |
| 4.  | Type of configuration:<br>(S/C, D/C, S/C strung on D/C towers, narrow base etc.)                                                                                                                                                  | Double Circuit (D/C)                                                                                            |
| 5.  | Number of Towers and Type of Towers failed:<br>[suspension / tension/dead end /special tower /river crossing tower/ Powerline crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 01 number, Tension type tower.<br>DB+6 (Strengthening for Weight Span).                                         |
| 6.  | Tower location No. with reference to nearest substation (indicate Name):                                                                                                                                                          | Tower No. 144<br>Nearest Substation: Kishenpur Sub-station                                                      |
| 7.  | Name and size of conductor:                                                                                                                                                                                                       | ACSR Moose, Nominal Diameter: 31.77 mm                                                                          |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                              | Twin with bundle spacing of 457 mm                                                                              |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                                | Earth-wire: 3.66 mm strand dia. and 10.98 mm nominal dia.<br>OPGW: 24 strand/12mm nominal dia.                  |
| 10. | Type of insulators in use (Porcelain / Glass / Polymer):                                                                                                                                                                          | Porcelain disc Insulators                                                                                       |
| 11. | Configuration of insulators (I / V / Y / tension)                                                                                                                                                                                 | Vertical configuration.<br>D/C Tension tower with DT (Double Tension) Insulator String.                         |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                        | “Double Tension” Insulator string having two pairs of 25 nos. of 160 kN porcelain discs.                        |
| 13. | Year of construction / commissioning:                                                                                                                                                                                             | LOA Ref No. & Date: CC-CS/80-NR2/TW-605/3/GI/P-201/CA-1/3577 dt 20.07.2010<br>Year of Commissioning: 29.07.2017 |
| 14. | Executing Agency:                                                                                                                                                                                                                 | M/s Tata Projects Ltd.                                                                                          |



|     |                                                                                                                                                                        |                                                                                                                                                                                                                                                     |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15. | Weather condition on the date of failure:                                                                                                                              | Extremely windy with local cyclone and snow/hailstorm                                                                                                                                                                                               |
| 16. | Terrain Category:                                                                                                                                                      | Tough hilly terrain with tower lying on the ridge line of Nathatop Range of Lesser Himalayas                                                                                                                                                        |
| 17. | Reliability Level                                                                                                                                                      | 1 (one)                                                                                                                                                                                                                                             |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind for which tower was designed:                                                                                             | Wind Zone-2, 39 m/sec                                                                                                                                                                                                                               |
| 19. | Details of Earthing of Tower (Pipe Type/ Counterpoise)                                                                                                                 | Counterpoise Earthing                                                                                                                                                                                                                               |
| 20. | Line designed as per IS: 802 (1977/1995/2015/any other code):                                                                                                          | IS: 802:1995 (LMSZ-15 mm)                                                                                                                                                                                                                           |
| 21. | The agency who designed the line:                                                                                                                                      | POWERGRID                                                                                                                                                                                                                                           |
| 22. | Any Special consideration in design:                                                                                                                                   | Strengthening was carried out in Tower to account for additional weight span.                                                                                                                                                                       |
| 23. | Details of last maintenance activity along with date                                                                                                                   | Jumper tightening works on dt. 21/12/2023                                                                                                                                                                                                           |
| 24. | Power flow in the line prior to failure:                                                                                                                               | Ckt-III: 248 MW<br>Ckt-IV: 248 MW                                                                                                                                                                                                                   |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | No                                                                                                                                                                                                                                                  |
| 26. | Condition of foundation after failure:                                                                                                                                 | Minor cracks observed on chimney of foundation.                                                                                                                                                                                                     |
| 27. | Brief Description of failure: [along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | One Number Tower (Loc. No. 144) collapsed.<br>Photographs, tower schedule, newspaper clippings attached.                                                                                                                                            |
| 28. | Probable cause of failure:                                                                                                                                             | Sliding/sinking of landmass around tower no. 144.                                                                                                                                                                                                   |
| 29. | Details of previous failure of the line / tower                                                                                                                        | Tower loc no. 145 of same line failed on 23.10.2021 at 1053 hrs. as per the detail below:<br><br>Tension Type, DC+3 "Reinforced" (Tower Collapsed with Chimney of legs A & B severely damaged & Chimney of legs C & D slightly damaged with cracks. |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                      | Line to be restored on spare tower                                                                                                                                                                                                                  |
| 31. | Likely date of restoration:                                                                                                                                            | 04.04.2024                                                                                                                                                                                                                                          |
| 32. | Present Status:                                                                                                                                                        | Heavy snowfall in whole of Nathatop range leading to snow accumulation on                                                                                                                                                                           |



|     |                                                                                                                                                           |                                                                                                                                   |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
|     |                                                                                                                                                           | site as well as connecting highways/link roads thus disrupting the transportation and accessibility of site for men and material. |
| 33. | Details of any Tests carried out after failure:                                                                                                           | Samples collected and sent to M/s. Geotech, Jammu (NABL accredited lab). Test Report attached.                                    |
| 34. | Wind Speed Data of Date and time of failure from nearby authorized observatory                                                                            | No IMD's Observatory located near the site<br>(Copy of e-mail from IMD attached)                                                  |
| 35. | Location of failed tower<br>a. Location Coordinates<br>b. Nearest Airport<br>c. District and State:                                                       | a. 75.24305555, 33.055555<br>b. Jammu<br>c. Udhampur, Jammu & Kashmir                                                             |
| 36. | Single line diagram / clearance diagram of the failed tower(s) with all dimensions (Horizontal and vertical dimensions including the base width of tower) | Attached (Structural drawing)                                                                                                     |
| 37. | Tower weight:                                                                                                                                             | 29.73 MT                                                                                                                          |
| 38. | Tower spotting data                                                                                                                                       | Attached                                                                                                                          |
| 39. | Tower schedule of affected section                                                                                                                        | Attached                                                                                                                          |
| 40. | Sag tension calculation considered for design of tower                                                                                                    | Attached in Tower Spotting Data (TSD)                                                                                             |
| 41. | Design document of failed towers:                                                                                                                         | Design parameters is indicated in Tower spotting data.                                                                            |
| 42. | Any other relevant information:                                                                                                                           |                                                                                                                                   |

**1.2 400 kV D/C Silchar-Imphal Transmission line**

|     |                                                                                                                                                                                                                             |                                                                         |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level                                                                                                                                                                                | 400 kV D/C Silchar-Imphal                                               |
| 2.  | Date and time of occurrence/discovery of failure                                                                                                                                                                            | 17.04.2024, 10.54 hrs.                                                  |
| 3.  | Length of line (km)                                                                                                                                                                                                         | 172 KM                                                                  |
| 4.  | Type of configuration<br>[(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                      | D/C (Double Circuit)                                                    |
| 5.  | Number of Towers and Type of Towers failed [Suspension/tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 01 number, Tension Tower (DC+3)                                         |
| 6.  | Tower location No. with reference to nearest substation (indicate Name)                                                                                                                                                     | Tower location no. 421,<br>Nearest substation- 400 kV Imphal substation |
| 7.  | Name and size of conductor                                                                                                                                                                                                  | ACSR Moose, Nominal diameter- 31.77 mm                                  |
| 8.  | No. of sub-conductors per bundle and bundle spacing                                                                                                                                                                         | Twin Conductor with bundle spacing of 457 mm                            |
| 9.  | Number and size of Ground wire/OPGW (if provided)                                                                                                                                                                           | Earth-wire: 10.98 mm nominal dia.<br>OPGW: 12 mm nominal dia.           |
| 10. | Type of insulators in use (Porcelain / Glass / Polymer)                                                                                                                                                                     | Porcelain insulator                                                     |
| 11. | Configuration of insulators (I / V / Y / tension)                                                                                                                                                                           | Double Tension String                                                   |



|     |                                                            |                                                                                                                                                                           |
|-----|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12. | No. of insulators per string and No. of strings per phase  | 23 Nos. disc insulators in each string and Double string/phase                                                                                                            |
| 13. | Year of construction / commissioning                       | LOA Date: 25.02.2011<br>Date of Commissioning: 21.05.2015                                                                                                                 |
| 14  | Executing Agency                                           | M/s IVRCL                                                                                                                                                                 |
| 15. | Weather condition on the date of failure                   | Clear sky                                                                                                                                                                 |
| 16  | Terrain Category                                           | Hilly                                                                                                                                                                     |
| 17. | Reliability Level                                          | 1 (One)                                                                                                                                                                   |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind: Zone         | WZ-6 and 55 m/sec                                                                                                                                                         |
| 19. | Details of earthing of tower (pipe type/ Counter poise):   | Counter poise Earthing                                                                                                                                                    |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code | IS 802: 1995                                                                                                                                                              |
| 21. | The agency who designed the line                           | POWERGRID                                                                                                                                                                 |
| 22. | Any Special consideration in design                        | No                                                                                                                                                                        |
| 23  | Details of last maintenance activity along with date       | Patrolling of above locations was carried out on 03.04.2024.                                                                                                              |
| 24. | Power flow in the line prior to failure                    | CKT # 2: 15 MW                                                                                                                                                            |
| 25. | Any missing member found before / after failure of towers  | No                                                                                                                                                                        |
| 26. | Condition of foundation after failure                      | Foundation of leg C, D got damaged & stub got dislocated from main foundation to distance of approx. 4 to 5 meters.<br><br>However, foundation & stub of leg A & B is ok. |
| 27. | Brief Description of failure                               | Two legs of tower were damaged by highly powerful IED by unknown                                                                                                          |



|     |                                                                                                                                               |                                                                                                                          |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
|     | [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / windstorm etc.]       | miscreants. Stub got dislocated from main foundation to about 4-5 meters. (Photographs/newspaper clippings attached)     |
| 28. | Probable cause of failure                                                                                                                     | Unknown miscreant damaged two legs of tower through highly powerful IED.                                                 |
| 29. | Details of previous failure of the line / tower                                                                                               | No                                                                                                                       |
| 30. | Whether line will be restored on ERS or Spare tower will be used                                                                              | Temporary restoration of ckt#2 by ERS. Permanent restoration on spare tower.                                             |
| 31  | Likely date of restoration                                                                                                                    | 15.06.2024                                                                                                               |
| 32. | Present Status                                                                                                                                | Ckt #1 is in service and Ckt # 2 is under shutdown.                                                                      |
| 33  | Details of any Tests carried out after failure (attach test reports)                                                                          | Samples identified and sent for approval                                                                                 |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory                                                                  | Not applicable.                                                                                                          |
| 35  | Location of failed tower                                                                                                                      |                                                                                                                          |
|     | Location Coordinates<br>Nearest Airport<br>District and State                                                                                 | Loc. 421- Coordinates: 93.7672905, 24.794919<br><br>Nearest airport- Imphal<br><br>District & State- Kangpokpi & Manipur |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Attached as structural drawing                                                                                           |
| 37. | Tower weight                                                                                                                                  | 30.31 MT                                                                                                                 |
| 38. | Tower spotting data                                                                                                                           | Attached                                                                                                                 |



|     |                                                        |                                 |
|-----|--------------------------------------------------------|---------------------------------|
| 39. | Tower schedule of affected section                     | Enclosed                        |
| 40. | Sag tension calculation considered for design of tower | Attached as Tower Spotting data |
| 41. | Design document of failed towers                       | Attached as Tower Spotting data |
| 42. | Any other relevant information                         |                                 |

**1.3 400 kV D/C Gaya- Koderma Transmission Line**

|     |                                                                                                                                                                                                                           |                                                                                             |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                             | 400 kV D/C Gaya- Koderma Transmission Line                                                  |
| 2.  | Date and time of occurrence/discovery of failure                                                                                                                                                                          | 23.04.2024 at 18:51 Hrs                                                                     |
| 3.  | Length of line (km):                                                                                                                                                                                                      | 125.789 km                                                                                  |
| 4.  | Type of configuration:<br>[(S/C, D/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                        | D/C                                                                                         |
| 5.  | Number of Towers and Type of Towers failed: [suspension/tension/dead end/special tower/river crossing tower/Powerline crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 07 nos. suspension type (05 No. DA+0 & 02 No. DA+3)                                         |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                   | Location no.-<br>203,204,205,206,207,208 & 209 from Gaya substation                         |
| 7.  | Name and size of conductor:                                                                                                                                                                                               | Quad Moose ACSR (Al strand - 54/3.53mm & Steel strand - 7/3.53mm, Overall diameter-31.77mm) |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                      | 04 No. & 450 mm spacing.                                                                    |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                        | No. Ground Earth wire (7/3.66 mm) Dia                                                       |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                   | Porcelain                                                                                   |
| 11. | Configuration of insulators (I / V / Y / tension)                                                                                                                                                                         | Double I suspension.                                                                        |



|     |                                                               |                                                             |
|-----|---------------------------------------------------------------|-------------------------------------------------------------|
| 12. | No. of insulators per string and<br>No. of strings per phase: | 23/string, 02 strings/phase                                 |
| 13. | Year of construction /<br>commissioning:                      | 2014                                                        |
| 14. | Executing Agency:                                             | M/s JSL                                                     |
| 15. | Weather condition on the date<br>of failure:                  | Heavy Localized cyclonic wind &<br>thunderstorm             |
| 16. | Terrain Category:                                             | Plain                                                       |
| 17. | Reliability Level                                             | 1                                                           |
| 18. | Wind Zone (1/2/3/4/5/6) and<br>velocity of wind:              | 2                                                           |
| 19. | Details of earthing of tower<br>(pipe type/Counter poise):    | Pipe type                                                   |
| 20. | Line designed as per IS:802<br>(1977/1995/any other code):    | IS:802 (1995)                                               |
| 21. | The agency who designed the<br>line:                          | POWERGRID in house designed tower                           |
| 22. | Any Special consideration in<br>design:                       | 75 % wind in security condition and narrow<br>front         |
| 23. | Details of last maintenance<br>activity along with date       | Last Patrolling done in October 2023. No<br>defect observed |
| 24. | Power flow in the line prior to<br>failure:                   | CKT-1 = 29.5 MW, & CKT-2 = 29.2 MW                          |
| 25. | Any missing member found<br>before / after failure of towers: | NIL                                                         |
| 26. | Condition of foundation after<br>failure:                     | OK                                                          |



|     |                                                                                                                                                                     |                                                                        |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 27. | Brief Description of failure: alongwith photographs(if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Local newspaper clipping attached. Annexure-1                          |
| 28. | Probable cause of failure:                                                                                                                                          | Heavy Localized cyclonic wind & thunderstorm.                          |
| 29. | Details of previous failure of the line / tower :                                                                                                                   | No previous failure.                                                   |
| 30. | Whetherline will be restored on ERS or Spare tower will be used:                                                                                                    | On spare towers.                                                       |
| 31. | Likely date of restoration:                                                                                                                                         | Restoration work commence at site. Likely to be charged by 10.05.2024. |
| 32. | Present Status:                                                                                                                                                     | Restoration of line under progress                                     |
| 33. | Details of any Tests carriedout after failure:                                                                                                                      | Samples collected. Test result awaited.                                |
| 34. | Wind speed data of date & time of failure from nearby authorised observatory:                                                                                       | Data has been requested to IMD.                                        |
| 35. | Location of failed tower                                                                                                                                            |                                                                        |
|     | a) Location Coordinates                                                                                                                                             | Attached as per annexure-2                                             |
|     | b)Nearesh Airport:                                                                                                                                                  | Gaya                                                                   |
|     | C) District and State:                                                                                                                                              | Gaya, Bihar                                                            |
| 36. | Single Line diagram/clearance diagram of failed tower(s) with all diamensions(Horizontal & vertical dimensions including base width of tower                        | Attached as per annexure-3                                             |
| 37. | Tower weight:                                                                                                                                                       | DA+0 = 17.07 MT/tower & DA+3= 19.72 MT/tower                           |
| 38. | Tower spotting data:                                                                                                                                                | Attached as per annexure-4                                             |



|     |                                                        |                            |
|-----|--------------------------------------------------------|----------------------------|
| 39. | Tower scheduled of affected section                    | Attached as per annexure-5 |
| 40. | Sag tension calculation considered for design of tower | Attached as per annexure-6 |
| 41. | Design document of failed towers:                      | Attached as per annexure-7 |
| 42. | Any other relevant information                         | NA                         |

**1.4 400 kV D/C Kishenpur-New Wanpoh III & IV**

|     |                                                                                                                                                                                                                                   |                                                                                                                                                                                             |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                     | 400 kV D/C Kishenpur-New Wanpoh III & IV                                                                                                                                                    |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                                 | 06:15 hrs/26.04.2024                                                                                                                                                                        |
| 3.  | Length of line (km):                                                                                                                                                                                                              | 135.15 kms                                                                                                                                                                                  |
| 4.  | Type of configuration:<br>(S/C, D/C, S/C strung on D/C towers, narrow base etc.)                                                                                                                                                  | Double Circuit (D/C)                                                                                                                                                                        |
| 5.  | Number of Towers and Type of Towers failed:<br>[suspension / tension/dead end /special tower /river crossing tower/ Powerline crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 03 no. of Tension type towers <ul style="list-style-type: none"> <li>• Tower at loc no. 225 (DC+0)</li> <li>• Tower at loc no. 226 (DB+0)</li> <li>• Tower at loc no. 227 (DD+3)</li> </ul> |
| 6.  | Tower location No. with reference to nearest substation (indicate Name):                                                                                                                                                          | Tower No. 225, 226 & 227<br>Nearest Substation: Kishenpur Sub-station                                                                                                                       |
| 7.  | Name and size of conductor:                                                                                                                                                                                                       | MOOSE, Nominal Diameter: 31.77 mm                                                                                                                                                           |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                              | Twin with bundle spacing of 457 mm                                                                                                                                                          |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                                | <ul style="list-style-type: none"> <li>• Earth-wire is 3.66 mm strand dia. and 10.98 mm nominal dia.</li> <li>• OPGW is 24 strand/12mm nominal dia.</li> </ul>                              |
| 10. | Type of insulators in use (Porcelain / Glass / Polymer):                                                                                                                                                                          | Porcelain discs                                                                                                                                                                             |
| 11. | Configuration of insulators (I / V / Y / tension)                                                                                                                                                                                 | Vertical configuration.<br>D/C Tension tower with DT (Double Tension) Insulator String.                                                                                                     |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                        | “Double Tension” string having two pairs of 25 nos. of 160 kN porcelain discs                                                                                                               |
| 13. | Year of construction / commissioning:                                                                                                                                                                                             | LOA Ref No. & Date: CC-CS/80-NR2/TW-605/3/GI/P-201/CA-1/3577<br>dt 20.07.2010<br>Year of Commissioning: 29.07.2017                                                                          |
| 14. | Executing Agency:                                                                                                                                                                                                                 | M/s Tata Projects Ltd.                                                                                                                                                                      |



|     |                                                                                                                                                                        |                                                                                                                                                                                                            |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15. | Weather condition on the date of failure:                                                                                                                              | Intermittently cloudy (with light rainfall)                                                                                                                                                                |
| 16. | Terrain Category:                                                                                                                                                      | Tough hilly terrain with tower lying on the banks of Chenab River in Village Parnote opposite Ramban NH 244.                                                                                               |
| 17. | Reliability Level                                                                                                                                                      | 1 (One)                                                                                                                                                                                                    |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind for which tower was designed:                                                                                             | Wind Zone-2, 39 m/sec                                                                                                                                                                                      |
| 19. | Details of Earthing of Tower (Pipe Type/ Counterpoise)                                                                                                                 | Counterpoise Earthing                                                                                                                                                                                      |
| 20. | Line designed as per IS: 802 (1977/1995/2015/any other code):                                                                                                          | IS: 802:1995 (LMSZ-15 mm)                                                                                                                                                                                  |
| 21. | The agency who designed the line:                                                                                                                                      | POWERGRID                                                                                                                                                                                                  |
| 22. | Any Special consideration in design:                                                                                                                                   | Strengthening was carried out in Tower to account for additional weight span.                                                                                                                              |
| 23. | Details of last maintenance activity along with date                                                                                                                   | Jumper & tower tightening works on dt. 21/12/2023                                                                                                                                                          |
| 24. | Power flow in the line prior to failure:                                                                                                                               | Zero (At 21:20 hrs. on 25.04.2024, Circuit III & IV taken under emergency S/D for precautionary purpose near habitations on directions of the District Admin as the land sinking was observed in the area) |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | No                                                                                                                                                                                                         |
| 26. | Condition of foundation after failure:                                                                                                                                 | Completely damaged                                                                                                                                                                                         |
| 27. | Brief Description of failure: [along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | A major landslide in an area of few sq kms with land sinking depth of over 12 m at some places along the Ramban Gool Sangaldan Road lead to collapse of tower nos 225, 226 & 227 on 26.04.2024             |
| 28. | Probable cause of failure:                                                                                                                                             | Mass land sinkage/Sliding of landmass around tower no. 225, 226 & 227                                                                                                                                      |
| 29. | Details of previous failure of the line / tower                                                                                                                        | Tower loc no. 145 of same line failed on 23.10.2021 at 1053 hrs. as per the detail below:<br>Tension Type, DC+3 "Reinforced" (Tower Collapsed with Chimney of legs A & B severely damaged & Chimney of     |



|     |                                                                                                                                                           |                                                                                                                                                                                                                                                                        |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                                                                                                                                           | <p>legs C &amp; D slightly damaged with cracks.</p> <p>Tower Loc No. 144 of same line failed on 19.02.2024 at 1212 hrs as per detail below:<br/>Tension Type, DB+6 “Reinforced” (Tower Collapsed with Sliding of landmass around tower no. 144 and chimney intact)</p> |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                         | ERS towers will be used.                                                                                                                                                                                                                                               |
| 31. | Likely date of restoration:                                                                                                                               | 15.06.2024                                                                                                                                                                                                                                                             |
| 32. | Present Status:                                                                                                                                           | The mass soil sinking is continued. GSI and NDRF are keeping a close vigil.                                                                                                                                                                                            |
| 33. | Details of any Tests carried out after failure:                                                                                                           | Samples identified and sent to lab for testing.                                                                                                                                                                                                                        |
| 34  | Wind Speed Data of Date and time of failure from nearby authorized observatory                                                                            | Not applicable                                                                                                                                                                                                                                                         |
| 35  | Location of failed tower<br>a. Location Coordinates<br>b. Nearest Airport<br>c. District and State:                                                       | Location coordinates-<br>a. 1.0 Loc. 225- 75.2053333, 33.2406111<br>2.0 Loc. 226- 75.2050944, 33.2411466<br>3.0 Loc. 227- 75.2026944, 33.2448611<br>b. Nearest airport- Jammu<br>c. District & State- Ramban, Jammu & Kashmir                                          |
| 36  | Single line diagram / clearance diagram of the failed tower(s) with all dimensions (Horizontal and vertical dimensions including the base width of tower) | Attached as Tower Spotting Data                                                                                                                                                                                                                                        |
| 37  | Tower weight                                                                                                                                              | 1.0 Loc. 225- 29.57 MT<br>2.0 Loc. 226- 25.22 MT<br>3.0 Loc. 227- 47.50 MT                                                                                                                                                                                             |
| 38  | Tower spotting data                                                                                                                                       | <br>Tower Spotting Data<br><br>Please click on above link                                                                                                                         |
| 39  | Tower schedule of affected section                                                                                                                        | Attached                                                                                                                                                                                                                                                               |



|    |                                                             |                                                              |
|----|-------------------------------------------------------------|--------------------------------------------------------------|
| 40 | Sag tension calculation considered for the design of towers | Attached in Tower Spotting Data (TSD)                        |
| 41 | Design document of failed towers:                           | Design parameters is indicated in Tower Spotting Data (TSD). |
| 42 | Any other relevant information:                             |                                                              |

### 1.5 400 kV D/C Abdullapur-Bawana / Deepalpur-Bawana

|     |                                                                                                                                                                                                                                   |                                                                                                                                                            |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                     | 400 kV D/C Abdullapur-Bawana / Deepalpur-Bawana                                                                                                            |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                                 | 1538 hrs/04.06.2024 and discovery immediately after failure                                                                                                |
| 3.  | Length of line (km):                                                                                                                                                                                                              | 166.80                                                                                                                                                     |
| 4.  | Type of configuration:<br>(S/C, D/C, S/C strung on D/C towers, narrow base etc.)                                                                                                                                                  | D/C                                                                                                                                                        |
| 5.  | Number of Towers and Type of Towers failed:<br>[suspension / tension/dead end /special tower /river crossing tower/ Powerline crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 01 no. of Suspension Type Tower at loc no. 434 (DA+0)- collapsed<br>01 no. of Suspension Type Tower at loc no. 433 (DA+6)- top cross arm and peak buckled. |
| 6.  | Tower location No. with reference to nearest substation (indicate Name):                                                                                                                                                          | Tower No. 434 & 433 counting from Abdullapur end.<br>However, failure location is near to Bawana Sub-station.                                              |
| 7.  | Name and size of conductor:                                                                                                                                                                                                       | SNOWBIRD, Nominal Diameter: 30.56 mm                                                                                                                       |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                              | Tripple with bundle spacing of 45.7 cm                                                                                                                     |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                                | Earth-wire is 3.66 mm strand dia. and 10.98 mm nominal dia.<br>OPGW is 24 strand/12mm nominal dia.                                                         |
| 10. | Type of insulators in use (Porcelain / Glass / Polymer):                                                                                                                                                                          | Polymer insulator                                                                                                                                          |
| 11. | Configuration of insulators (I / V / Y / tension)                                                                                                                                                                                 | Vertical configuration D/C Suspension tower with each insulator string using Single V Suspension                                                           |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                        | “Single V Suspension” string having One pair of CLRI having 160 kN polymer insulators                                                                      |



|     |                                                                                                                                                                        |                                                                                                                                                                                                                  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13. | Year of construction / commissioning:                                                                                                                                  | Date of Commissioning: 1st Jan, 2000                                                                                                                                                                             |
| 14. | Executing Agency:                                                                                                                                                      | KEC International LTD.                                                                                                                                                                                           |
| 15. | Weather condition on the date of failure:                                                                                                                              | Generally sunny with calm winds                                                                                                                                                                                  |
| 16. | Terrain Category:                                                                                                                                                      | Plain terrain                                                                                                                                                                                                    |
| 17. | Reliability Level                                                                                                                                                      | 1 (One)                                                                                                                                                                                                          |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind for which tower was designed:                                                                                             | Wind Zone-IV, 47 m/sec                                                                                                                                                                                           |
| 19. | Details of earthing of towers (Pipe/CP)                                                                                                                                | PIPE in both towers                                                                                                                                                                                              |
| 20. | Line designed as per IS: 802 (1977/1995/2015/any other code):                                                                                                          | IS 802:1995                                                                                                                                                                                                      |
| 21. | The agency who designed the line:                                                                                                                                      | M/s SAE                                                                                                                                                                                                          |
| 22. | Any Special consideration in design:                                                                                                                                   | No                                                                                                                                                                                                               |
| 23. | Details of last maintenance activity along with date                                                                                                                   | No major maintenance carried out on this tower                                                                                                                                                                   |
| 24. | Power flow in the line prior to failure:                                                                                                                               | 400 kV Deepalpur Bawana TL was already under shutdown since 13:35 hrs 04.06.2024. At 15:38 hrs 04.06.2024, 400 kV Abdullapur Bawana tripped due to collapse of tower, and at that time, flow of power was 290MW. |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | No                                                                                                                                                                                                               |
| 26. | Condition of foundation after failure:                                                                                                                                 | Foundation chimney and stub are ok.                                                                                                                                                                              |
| 27. | Brief Description of failure: [along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind-storm etc.] | Tower has collapsed owing to sabotage by miscreants. Subsequently, two top cross-arms and top earth-peaks of Tower Loc No. 433 got damaged due to sudden jerk.                                                   |
| 28. | Probable cause of failure:                                                                                                                                             | Sabotage by Miscreants                                                                                                                                                                                           |



| 29.           | Details of previous failure of the line / tower                                                                                                           | Tower (DA+18) at location no 418 failed due to localized wind in year 2014.                                                                                                                                                                                                                                                                                                                                                                                               |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------|-------------|-----|------|-----|-----|------|-----|-----|----|-----|------------|-------------|------------|------------|-----------|------------|-----|----|-----|
| 30.           | Whether line will be restored on ERS or Spare tower will be used:                                                                                         | Spare tower will be used.                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 31.           | Likely date of restoration:                                                                                                                               | 12.06.2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 32.           | Present Status:                                                                                                                                           | Tower members along with material is being transported to site.<br>Immediately after CEA and investigation committee visit, the restoration work shall be started.                                                                                                                                                                                                                                                                                                        |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 33.           | Details of any Tests carried out after failure:                                                                                                           | Tower member identified and sent to NABL lab for testing.                                                                                                                                                                                                                                                                                                                                                                                                                 |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 34            | Wind speed and duration at the time of failure                                                                                                            | Failure happens due to sabotage so wind data is not required.                                                                                                                                                                                                                                                                                                                                                                                                             |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 35            | Location of Failed Tower:<br>Location Coordinates<br>Nearest Airport<br>District and State                                                                | 77.0655305556E, 28.8072388889N<br>Delhi Airport<br>North West Delhi Distt., NCT Delhi                                                                                                                                                                                                                                                                                                                                                                                     |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 36            | Single line diagram / clearance diagram of the failed tower(s) with all dimensions (Horizontal and vertical dimensions including the base width of tower) | SLD at Annexure-A                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 37            | Tower Weight                                                                                                                                              | 13.20 MT for Collapse Tower Location No. 434                                                                                                                                                                                                                                                                                                                                                                                                                              |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 38            | Tower spotting data                                                                                                                                       | <br>TSD Abdullapur Bawana.pdf                                                                                                                                                                                                                                                                                                                                                        |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 39            | Tower Schedule for the failed section                                                                                                                     | <table border="1"> <thead> <tr> <th>Tower Ref No:</th><th>Tower Type</th><th>Span Length</th></tr> </thead> <tbody> <tr> <td>430</td><td>DB+6</td><td>430</td></tr> <tr> <td>431</td><td>DA+6</td><td>410</td></tr> <tr> <td>432</td><td>DA</td><td>435</td></tr> <tr> <td><b>433</b></td><td><b>DA+6</b></td><td><b>435</b></td></tr> <tr> <td><b>434</b></td><td><b>DA</b></td><td><b>405</b></td></tr> <tr> <td>435</td><td>DA</td><td>400</td></tr> </tbody> </table> | Tower Ref No: | Tower Type | Span Length | 430 | DB+6 | 430 | 431 | DA+6 | 410 | 432 | DA | 435 | <b>433</b> | <b>DA+6</b> | <b>435</b> | <b>434</b> | <b>DA</b> | <b>405</b> | 435 | DA | 400 |
| Tower Ref No: | Tower Type                                                                                                                                                | Span Length                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 430           | DB+6                                                                                                                                                      | 430                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 431           | DA+6                                                                                                                                                      | 410                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 432           | DA                                                                                                                                                        | 435                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| <b>433</b>    | <b>DA+6</b>                                                                                                                                               | <b>435</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| <b>434</b>    | <b>DA</b>                                                                                                                                                 | <b>405</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |
| 435           | DA                                                                                                                                                        | 400                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |            |             |     |      |     |     |      |     |     |    |     |            |             |            |            |           |            |     |    |     |



|    |                                                             |                        |
|----|-------------------------------------------------------------|------------------------|
| 40 | Sag tension calculation considered for the design of towers | Attached at Annexure-B |
| 41 | Design Document of Failed Towers                            | Attached at Annexure-C |
| 42 | Any other relevant information:                             | NIL                    |

## 1.6 765 kV S/C Gwalior-Agra #1

|     |                                                                                                                                                                                                                             |                                                                                           |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level                                                                                                                                                                                | 765 kV S/C Gwalior-Agra #1                                                                |
| 2.  | Date and time of occurrence/discovery of failure                                                                                                                                                                            | 12.09.2024 at 18:07 Hrs                                                                   |
| 3.  | Length of line (km)                                                                                                                                                                                                         | 129.44 KMs                                                                                |
| 4.  | Type of configuration [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                         | Single Circuit Configuration                                                              |
| 5.  | Number of Towers and Type of Towers failed [Suspension/tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 01 no, A type Tower (A+ 6 extn.)<br>{River Crossing Tower of Asan River (seasonal river)} |
| 6.  | Tower location No. with reference to nearest substation (indicate Name)                                                                                                                                                     | Gwalior station, Tower no 159                                                             |
| 7.  | Name and size of conductor                                                                                                                                                                                                  | ACSR Bersimis Conductor (Al-42/4.57mm & Steel-7/2.54 mm, overall dia-35.04mm)             |
| 8.  | No. of sub-conductors per bundle and bundle spacing                                                                                                                                                                         | Quad Conductor (450 mm)                                                                   |
| 9.  | Number and size of Ground wire/OPGW (if provided)                                                                                                                                                                           | 2 No Earth-wire (7/3.63mm)                                                                |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer)                                                                                                                                                                      | Composite Long Rod Polymer                                                                |



|     |                                                                                                                                                                       |                                                                                                                         |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 11. | Configuration of insulators (I / V / Y / tension)                                                                                                                     | Quad Tension String- 210 KN                                                                                             |
| 12. | No. of insulators per string and No. of strings per phase                                                                                                             | 2 Nos insulators per string & 04 strings per phase (Doble I Suspension String)                                          |
| 13. | Year of construction / commissioning                                                                                                                                  | 01.04.2007                                                                                                              |
| 14  | Executing Agency                                                                                                                                                      | M/s Jyoti Structure Limited, Mumbai                                                                                     |
| 15. | Weather condition on the date of failure                                                                                                                              | Continuous heavy rain and flooding in Asan River due to automatic opening of gates of Pagara Dam & Kotwal Dam.          |
| 16  | Terrain Category                                                                                                                                                      | 2                                                                                                                       |
| 17. | Reliability Level                                                                                                                                                     | 2                                                                                                                       |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind: Zone                                                                                                                    | 4 (Basic wind speed-47m/sec)                                                                                            |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                              | Pipe earthing                                                                                                           |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code                                                                                                            | 1995                                                                                                                    |
| 21. | The agency who designed the line                                                                                                                                      | POWRGRID Standard Design, Delta Configuration                                                                           |
| 22. | Any Special consideration in design                                                                                                                                   | Nil                                                                                                                     |
| 23  | Details of last maintenance activity along with date                                                                                                                  | The patrolling of above locations was carried out on 03.04.2024 in previous cycle and no missing members were reported. |
| 24. | Power flow in the line prior to failure                                                                                                                               | 321 MW                                                                                                                  |
| 25. | Any missing member found before / after failure of towers                                                                                                             | No                                                                                                                      |
| 26. | Condition of foundation after failure                                                                                                                                 | All stubs bend.                                                                                                         |
| 27. | Brief Description of failure [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Enclosed                                                                                                                |



|     |                                                                                                                                               |                                                                                                                                                     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 28. | Probable cause of failure                                                                                                                     | Flash Flood in Asan River due to automatic opening of gates of Pagara Dam & Kotwal Dam on 12.09.2024                                                |
| 29. | Details of previous failure of the line / tower                                                                                               | Loc no 247 (Chambal River Crossing Tower) on 24 <sup>th</sup> August 2022 due to flash flood generated due to opening of gates of Gandhi Sagar Dam. |
| 30. | Whether line will be restored on ERS or Spare tower will be used                                                                              | Spare tower shall be used                                                                                                                           |
| 31. | Likely date of restoration                                                                                                                    | 10.10.2024                                                                                                                                          |
| 32. | Present Status                                                                                                                                | Out of Service                                                                                                                                      |
| 33. | Details of any Tests carried out after failure (attach test reports)                                                                          | Sample identified collected for testing.                                                                                                            |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory                                                                  | Not applicable                                                                                                                                      |
| 35. | Location of failed tower                                                                                                                      |                                                                                                                                                     |
|     | <b>a.</b> Location Coordinates<br><br><b>b.</b> Nearest Airport<br><br><b>c.</b> District and State                                           | Longitude:<br>78.28990659<br><br>Latitude :<br>26.5724764<br><br>Gwalior<br><br>Morena, MP                                                          |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Enclosed                                                                                                                                            |
| 37. | Tower weight                                                                                                                                  | 26.97 MT                                                                                                                                            |
| 38. | Tower spotting data                                                                                                                           | Enclosed                                                                                                                                            |
| 39. | Tower schedule of affected section                                                                                                            | Enclosed                                                                                                                                            |
| 40. | Sag tension calculation considered for design of tower                                                                                        | Enclosed                                                                                                                                            |



|     |                                  |          |
|-----|----------------------------------|----------|
| 41. | Design document of failed towers | Enclosed |
| 42. | Any other relevant information   |          |

**2. ADANI**

The following Transmission Lines Towers of ADANI had failed during January, 2024 to December, 2024.

| Si. No. | Name of the Transmission Line                                       | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor                 |
|---------|---------------------------------------------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|---------------------------|
|         |                                                                     |                 |                 |                       |           | Suspension           | Tension | Total |                           |
| 2.1     | 765 kV D/C BILASPUR – RAJNANDGAON TRANSMISSION LINE - Circuit 1 & 2 | ADANI           | 10.05.2024      | 2019                  | 2         | 4                    | 0       | 4     | 765 kV Hexa Zebra         |
| 2.2     | 765 kV S/C AKOLA (2) – EKTUNI LINE – 2                              | ADANI           | 26.05.2024      | 2016                  | 2         | 4                    | 0       | 4     | 765 kV Quad Bersimis ACSR |

**2.1 765 kV D/C BILASPUR – RAJNANDGAON TRANSMISSION LINE -Circuit 1 & 2**

(SIPAT TRANSMISSION LIMITED)

|   |                                                                                     |                                                                                                                                                                                                                                                                               |
|---|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Name of Transmission line with voltage level                                        | 765 kV D/C BILASPUR – RAJNANDGAON TRANSMISSION LINE -Circuit 1 & 2                                                                                                                                                                                                            |
| 2 | Date and time:<br>Occurrence of failure<br>2. Discovery of failure                  | Occurrence of failure<br><br>765kV D/C BILASPUR – RAJNANDGAON TRANSMISSION LINE -Circuit 2 at 10.05.2024, 18:04 hrs.<br><br>765kV D/C BILASPUR – RAJNANDGAON TRANSMISSION LINE -Circuit 1 at 10.05.2024, 18:12 hrs.<br><br>Discovery of failure<br><br>10.05.2024, 20:30 hrs. |
| 3 | Length of line (km)                                                                 | 162 km                                                                                                                                                                                                                                                                        |
| 4 | Type of configuration [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)] | D/C strung on D/C towers                                                                                                                                                                                                                                                      |



|    |                                                                                                                                                                                                                                 |                                                                                                                  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 5  | Number of Towers and Type of Towers failed<br>[Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | Four Towers (4 no.), Suspension Tower “DHA” with extension +0 M (2 Nos.), +1.5M (1 Nos.) & +3M (1 Nos.)          |
| 6  | Tower location No. with reference to nearest substation                                                                                                                                                                         | TN - 63 (DHA+0), TN 64 -(DHA+0), TN 65 (DHA+3) and TN 66 (DHA+1.5) – Nearest to Bilaspur (Powergrid) Sub-station |
| 7  | Name and size of conductor                                                                                                                                                                                                      | ACSR ZEBRA CONDUCTOR, 28.62 mm Overall diameter 54/3.18 mm Al + 7/3.18 mm steel                                  |
| 8  | No. of sub-conductors per bundle and bundle spacing                                                                                                                                                                             | 6 nos. of sub conductor/phase (Hexa Bundle), Bundle spacing – $457 \pm 5$ mm                                     |
| 9  | Number and size of Ground wire/OPGW                                                                                                                                                                                             | 1 no. of 7/3.66 G.S EARTHWIRE (10.98 mm diameter) & 1 no, of 24-F OPGW.                                          |
| 10 | Type of insulators in use (Porcelain / Glass / Polymer)                                                                                                                                                                         | 160kN Suspension Polymer Insulator                                                                               |
| 11 | Configuration of insulators (I / V / Y / tension)                                                                                                                                                                               | Double I-Type Configuration of Insulator                                                                         |
| 12 | No. of insulators per string and No. of strings per phase                                                                                                                                                                       | 2 nos. per String<br>4 nos. per Phase                                                                            |
| 13 | Year of construction / commissioning                                                                                                                                                                                            | 2019                                                                                                             |
| 14 | Executing Agency                                                                                                                                                                                                                | M/s Gammon India Ltd.                                                                                            |
| 15 | Weather condition on the date of failure                                                                                                                                                                                        | Heavy rain with thunderstorm, sporadic heavy whirl wind followed by localized cyclonic storm                     |
| 16 | Terrain Category                                                                                                                                                                                                                | Category-2                                                                                                       |
| 17 | Reliability Level                                                                                                                                                                                                               | Reliability Level – 2                                                                                            |
| 18 | Wind Zone (1/2/3/4/5/6) and velocity of wind                                                                                                                                                                                    | Wind Zone-2, Basic wind speed – 39 m/s                                                                           |
| 19 | Details of earthing of tower (pipe type/ Counter poise)                                                                                                                                                                         | Pipe Type Earthing                                                                                               |
| 20 | Line designed as per IS:802 (1977/1995/2015 any other code)                                                                                                                                                                     | IS 802:1995                                                                                                      |



|    |                                                                                                                                                                       |                                                                                                                                                                                                                             |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21 | The agency who designed the line                                                                                                                                      | M/s Gammon India Ltd.                                                                                                                                                                                                       |
| 22 | Any Special consideration in design                                                                                                                                   | No                                                                                                                                                                                                                          |
| 23 | Details of last maintenance activity along with date                                                                                                                  | 13-March-2024                                                                                                                                                                                                               |
| 24 | Power flow in the line prior to failure                                                                                                                               | Ckt-1: 1591 MW<br>Ckt-2: 1116 MW                                                                                                                                                                                            |
| 25 | Any missing member found before / after failure of towers                                                                                                             | No                                                                                                                                                                                                                          |
| 26 | Condition of foundation after failure                                                                                                                                 | Foundation is intact, Upper portion of chimney & stub is damaged                                                                                                                                                            |
| 27 | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / windstorm etc.] | Enclosed                                                                                                                                                                                                                    |
| 28 | Probable cause of failure                                                                                                                                             | Due to heavy sporadic whirl wind followed by localized cyclonic storm might have exceeded the designed wind speed damaged the tower no 63 first and 3 Nos. of succeeded tower collapsed subsequently after gap of 8 Minutes |
| 29 | Details of previous failure of the line / tower                                                                                                                       | TN 413 (DHA+3) on dtd 21st May,2022                                                                                                                                                                                         |
| 30 | Whether line will be restored on ERS, or Spare tower will be used                                                                                                     | First circuit shall be restored on ERS and spare towers shall be used for permanent restoration at original co-ordinates                                                                                                    |
| 31 | Likely date of restoration                                                                                                                                            | 21.05.2024 (One Circuit on ERS)<br>30.05.2024 (Both circuit on Original Co-ordinates)                                                                                                                                       |
| 32 | Present Status                                                                                                                                                        | Restoration is under progress                                                                                                                                                                                               |
| 33 | Details of any Tests carried out after failure (attach test reports)                                                                                                  | Damaged member shall be sent to NABL certified laboratory for material testing. Report shall be shared to CEA-PSETD after test result arrives.                                                                              |
| 34 | Wind speed data of date & time of failure from nearby authorized observatory                                                                                          | Request letter shall be sent to IMD-Nagpur & Raipur to provide us the real time wind speed data. However, we have enclosed documentary evidence viz. photographs, newspaper /media                                          |



|    |                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                      |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                                                                               | reports of the thunderstorm/cyclonic events & associated damages to trees/infrastructure/human & cattle life, etc. which shows the high wind speed in the affected area.                                                                                                                                                                             |
| 35 | Location of failed tower:<br>Location Coordinates<br>Nearest Airport<br>District and State                                                    | 1.TN 63- GPS Co-ordinates latitude-220.8'34.84" Longitude-810 59'21.27"<br>2.TN 64- GPS Co-ordinates latitude-220.8'36.84" Longitude-810 59'21.27"<br>3.TN 65- GPS Co-ordinates latitude-220.8'29.95" Longitude-810 59'10.37"<br>4.TN 66- GPS Co-ordinates latitude-220.8'23.09" Longitude-810 58'59.53"<br><br>Nearest Airport: - Bilaspur & Raipur |
| 36 | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Enclosed                                                                                                                                                                                                                                                                                                                                             |
| 37 | Tower weight                                                                                                                                  | 31.26 MT (DHA +0)<br>31.93 MT (DHA +1.5)<br>32.74 MT (DHA +3)                                                                                                                                                                                                                                                                                        |
| 38 | Tower spotting data                                                                                                                           | Enclosed                                                                                                                                                                                                                                                                                                                                             |
| 39 | Tower schedule of affected section                                                                                                            | Enclosed                                                                                                                                                                                                                                                                                                                                             |
| 40 | Sag tension calculation considered for design of tower                                                                                        | Enclosed                                                                                                                                                                                                                                                                                                                                             |
| 41 | Design document of failed towers                                                                                                              | Enclosed                                                                                                                                                                                                                                                                                                                                             |
| 42 | Any other relevant information                                                                                                                | -                                                                                                                                                                                                                                                                                                                                                    |

**2.2 765 kV 765 kV S/C AKOLA (2) – EKTUNI LINE – 2**

|    |                                                                                                                                                                                                                                 |                                                                                                                                                  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Name of Transmission line with voltage level                                                                                                                                                                                    | 765 kV S/C AKOLA (2) – EKTUNI LINE – 2                                                                                                           |
| 2  | Date and time:<br>Occurrence of failure<br>Discovery of failure                                                                                                                                                                 | 26.05.2024, 18:10 hrs.<br>26.05.2024, 19:00 hrs.                                                                                                 |
| 3  | Length of line (km)                                                                                                                                                                                                             | 220 km                                                                                                                                           |
| 4  | Type of configuration<br>[(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                          | S/C                                                                                                                                              |
| 5  | Number of Towers and Type of Towers failed<br>[Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | Four Suspension Towers (4 no.) collapsed. A+0 Single circuit configuration                                                                       |
| 6  | Tower location No. with reference to nearest substation                                                                                                                                                                         | Tower No. 125, 126, 127 & 128, 70 kms from Akola-2 (MEGPTCL) Substation                                                                          |
| 7  | Name and size of conductor                                                                                                                                                                                                      | ACSR BERSIMIS CONDUCTOR, 35.05 mm Overall diameter 42/4.57 mm Al + 7/2.54 mm steel                                                               |
| 8  | No. of sub-conductors per bundle and bundle spacing                                                                                                                                                                             | 4 nos. of sub conductor/phase (Quad Bundle), Bundle spacing – 457 ± 5 mm                                                                         |
| 9  | Number and size of Ground wire/OPGW                                                                                                                                                                                             | A. 1 no. of 7/3.66 G.S EARTHWIRE<br>B. 1 no, of 8-Fiber OPGW.                                                                                    |
| 10 | Type of insulators in use (Porcelain / Glass / Polymer)                                                                                                                                                                         | 120kN Suspension Glass Insulator in I Strings,<br>210kN Suspension Glass insulator in V String.                                                  |
| 11 | Configuration of insulators (I / V / Y / tension)                                                                                                                                                                               | Double I-Type Configuration of Insulator (Suspension) & V -Type Configuration of Insulator (I-V-I Type Configuration)                            |
| 12 | No. of insulators per string and No. of strings per phase                                                                                                                                                                       | Double I : 80 nos. of disc insulators per string & 2 Strings per phase<br>Single V : 70 nos. disc of insulators per string & 1 Strings per phase |
| 13 | Year of construction / commissioning                                                                                                                                                                                            | March-2016                                                                                                                                       |



|    |                                                                                                                                                                       |                                                                                                                             |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 14 | Executing Agency                                                                                                                                                      | KALPATARU POWER TRANSMISSION LIMITED (M/s KPTL)                                                                             |
| 15 | Weather condition on the date of failure                                                                                                                              | Sporadic heavy whirl wind followed by localized cyclonic storm with rainfall                                                |
| 16 | Terrain Category                                                                                                                                                      | Category-2                                                                                                                  |
| 17 | Reliability Level                                                                                                                                                     | Reliability Level - 2                                                                                                       |
| 18 | Wind Zone (1/2/3/4/5/6) and velocity of wind                                                                                                                          | Wind Zone-2, Basic wind speed – 39 m/s                                                                                      |
| 19 | Details of earthing of tower (pipe type/ Counter poise)                                                                                                               | Counter Poise Earthing                                                                                                      |
| 20 | Line designed as per IS:802 (1977/1995/2015 any other code)                                                                                                           | IS 802:1995                                                                                                                 |
| 21 | The agency who designed the line                                                                                                                                      | Powergrid Corporation of India Limited (PGCIL)                                                                              |
| 22 | Any Special consideration in design                                                                                                                                   | No                                                                                                                          |
| 23 | Details of last maintenance activity along with date                                                                                                                  | 29.02.2024                                                                                                                  |
| 24 | Power flow in the line prior to failure                                                                                                                               | Ckt-2: 788 MW                                                                                                               |
| 25 | Any missing member found before / after failure of towers                                                                                                             | No                                                                                                                          |
| 26 | Condition of foundation after failure                                                                                                                                 | The foundation of TN 126 & 128 is remained intact. Foundation (Top portion of stub) Chimney of TN 125 & 127 is got damaged. |
| 27 | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / windstorm etc.] | Enclosed in preliminary report                                                                                              |
| 28 | Probable cause of failure                                                                                                                                             | Due to heavy gusty wind followed by localized whirl wind.                                                                   |
| 29 | Details of previous failure of the line / tower                                                                                                                       | No previous failure since commissioning                                                                                     |
| 30 | Whether line will be restored on ERS, or Spare tower will be used                                                                                                     | Spare tower materials shall be used for permanent restoration.                                                              |
| 31 | Likely date of restoration                                                                                                                                            | 10.06.2024                                                                                                                  |
| 32 | Present Status                                                                                                                                                        | Restoration work is in progress.                                                                                            |



|    |                                                                                                                                               |                                                                                                                                                                                                                                                                                  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 33 | Details of any Tests carried out after failure (attach test reports)                                                                          | It is observed that the tower collapsed due to nature's fury. No technical deficiencies were observed in the collapsed tower. Sample collection of damaged tower is in progress and shall be sent to NABL certified laboratory.                                                  |
| 34 | Wind speed data of date & time of failure from nearby authorized observatory                                                                  | We have requested Indian Meteorological Department (IMD) to provide relevant weather data at incident location from their nearest observatory. However, IMD has no data available for this particular location due to absence of weather observatory                             |
| 35 | Location of failed tower:<br>Location Coordinates<br>Nearest Airport<br>District and State                                                    | A1. 20°31'48.48"N, 76°45'42.82"E<br>A2. 20°31'50.65"N, 76°45'29.96"E<br>A3. 20°31'53.32"N, 76°45'16.84"E<br>A4. 20°31'55.74"N, 76°45'3.81"E<br>b. Akola (Maharashtra) Airport, 50 km from Tower & Nagpur Airport, 350 Km from Tower<br>c. District: Buldhana, State: Maharashtra |
| 36 | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Enclosed                                                                                                                                                                                                                                                                         |
| 37 | Tower weight                                                                                                                                  | A+0 tower: 19.20 MT                                                                                                                                                                                                                                                              |
| 38 | Tower spotting data                                                                                                                           | Enclosed                                                                                                                                                                                                                                                                         |
| 39 | Tower schedule of affected section                                                                                                            | Enclosed                                                                                                                                                                                                                                                                         |
| 40 | Sag tension calculation considered for design of tower                                                                                        | Enclosed                                                                                                                                                                                                                                                                         |
| 41 | Design document of failed towers                                                                                                              | Not available as tower drawings were purchased from PGCIL under consultancy services.                                                                                                                                                                                            |
| 42 | Any other relevant information                                                                                                                | Localized cyclone were so heavy that surrounding infrastructure were also damaged. Preliminary Report is enclosed with this performa.                                                                                                                                            |

**3. RVPN**

The following Transmission Lines Towers of RVPN had failed during January 2024 to December 2024.

| Si. No. | Name of the Transmission Line        | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor              |
|---------|--------------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|------------------------|
|         |                                      |                 |                 |                       |           | Suspension           | Tension | Total |                        |
| 3.1     | 220 kV MIA-BTPS LINE                 | RVPN            | 25.03.2024      | 1976                  | NA        | 2                    | 0       | 2     | 220 kV Single Zebra    |
| 3.2     | 400 kV D/C Bhadla-Jodhpur-Merta Line | RVPN            | 05.07.2024      | 01.09.2019            | 4         | 5                    | 0       | 5     | 400 kV Twin MOOSE ACSR |

**3.1 220 kV MIA-BTPS LINE**

|    |                                                                                                                                                                                                                           |                                   |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 01 | Name of Transmission line with voltage level                                                                                                                                                                              | 220 kV MIA-BTPS LINE              |
| 02 | Date and time of occurrence/discovery of failure                                                                                                                                                                          | 05.01.2024, 25.03.2024            |
| 03 | Length of line (km):                                                                                                                                                                                                      | 131.7 KM                          |
| 04 | Type of configuration:[(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)                                                                                                                                        | S/C                               |
| 05 | Number of Towers and Type of Towers failed:[Suspension/tension/dead end/special tower/river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension) | 02 NOS (A & A+6)                  |
| 06 | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                   | 190 & 191 of 220 KV MIA BTPS Line |
| 07 | Name and size of conductor:                                                                                                                                                                                               | zebra conductor                   |
| 08 | No. of sub-conductors per bundle and bundle spacing                                                                                                                                                                       | Single                            |
| 09 | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                        | 7/4 sq. mm                        |
| 10 | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                   | Polymer                           |



|    |                                                                   |                                                                         |
|----|-------------------------------------------------------------------|-------------------------------------------------------------------------|
| 11 | Configuration of insulators (I / V / Y / tension):                | I type suspension                                                       |
| 12 | No. of insulators per string and No. of strings per phase:        | 01 String per phase                                                     |
| 13 | Year of construction / commissioning:                             | 1976                                                                    |
| 14 | Executing Agency:                                                 | the then RSEB                                                           |
| 15 | Weather condition on the date of failure:                         | Normal                                                                  |
| 16 | Terrain Category:                                                 | Dry                                                                     |
| 17 | Reliability Level:                                                | NA                                                                      |
| 18 | Wind Zone (1/2/3/4/5/6) and velocity of wind:                     | NA                                                                      |
| 19 | Details of earthing of tower (pipe type/ Counter poise):          | Pipe type                                                               |
| 20 | Line designed as per IS:802 (1977/1995/2015 any other code):      | NA                                                                      |
| 21 | The agency who designed the line:                                 | the then RSEB                                                           |
| 22 | Any Special consideration in design:                              | NA                                                                      |
| 23 | Details of last maintenance activity along with date:             | Patrolling wef 07.08.2023 to 12.08.2023                                 |
| 24 | Power flow in the line prior to failure                           | NIL, Line charged for antitheft purpose                                 |
| 25 | Any missing member found before / after failure of towers:        | NIL                                                                     |
| 26 | Condition of foundation after failure:                            | OK                                                                      |
| 27 | Brief Description of failure:                                     | Tower fail due to theft the conductor between T L No 190 -191 & 191-192 |
| 28 | Probable cause of failure:                                        | Sudden thrust due to conductor cut by unknown thieves                   |
| 29 | Details of previous failure of the line / tower :                 | 03 nos tower of 220 KV MIA BTPS Line on Dt. 19.05.2015                  |
| 30 | Whether line will be restored on ERS or Spare tower will be used: | Not restored till now                                                   |



|    |                                                                                                                                               |                                                                                        |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 31 | Likely date of restoration:                                                                                                                   | File under process                                                                     |
| 32 | Present Status:                                                                                                                               | Line charged for anti theft purpose                                                    |
| 33 | Details of any Tests carried out after failure(attach test reports):                                                                          | NA                                                                                     |
| 34 | Wind speed data of date & time of failure from nearby authorized observatory                                                                  | NA                                                                                     |
| 35 | Location of failed tower                                                                                                                      |                                                                                        |
| A  | Location Coordinates:                                                                                                                         | Long.-28.076194, Lat.-77.086972 (T L 190), Long - 28.074528, Lat - 77.083972 (T L 191) |
| B  | Nearest Airport:                                                                                                                              | Delhi                                                                                  |
| C  | District and State:                                                                                                                           | Nuh, Haryana                                                                           |
| 36 | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | NA                                                                                     |
| 37 | Design document of failed towers:                                                                                                             | NA                                                                                     |
| 38 | Tower weight:                                                                                                                                 | NA                                                                                     |
| 39 | Tower spotting data:                                                                                                                          | NA                                                                                     |
| 40 | Sag tension calculation considered for design of tower                                                                                        | NA                                                                                     |
| 41 | Design document of failed towers:                                                                                                             | NA                                                                                     |
| 42 | Any other relevant information:                                                                                                               | NA                                                                                     |

### 3.2 400 kV D/C Bhadla-Jodhpur-Merta Line

|     |                                                                                                                                                                                                                               |                                       |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                 | 400 kV D/C Bhadla-Jodhpur-Merta Line  |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                             | 05.07.2024 at 19:12 Hrs.              |
| 3.  | Length of line (km):                                                                                                                                                                                                          | 207.2 KM Jodhpur end, 304.27 KM Merta |
| 4.  | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)                                                                                                                                           | D/C                                   |
| 5.  | Number of Towers and Type of Towers failed: [Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 05 Nos. Suspension                    |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                       | Loc. No. 476 to 480                   |
| 7.  | Name and size of conductor:                                                                                                                                                                                                   | Twin Moose Conductor-597.2 Sq. MM     |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                          | AL-54/3.53 and Steel-7/3.53           |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                            | Ground (7/3.66 mm) & OPGW (24 Fiber)  |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                       | Porcelain                             |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                            | I                                     |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                    | 23 and 1                              |
| 13. | Year of construction / commissioning:                                                                                                                                                                                         | 01.09.2019 Jodhpur/ Merta             |
| 14. | Executing Agency:                                                                                                                                                                                                             | RVPN                                  |
| 15. | Weather condition on the date of failure:                                                                                                                                                                                     | Heavy Rain ,wind Storm & lightning    |
| 16. | Terrain Category:                                                                                                                                                                                                             | Sandy Plain                           |
| 17. | Reliability Level:                                                                                                                                                                                                            |                                       |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                                                                                 | 4 and 47 m/s                          |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                                                                                      | Counter poise                         |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                                                                                  | -                                     |
| 21. | The agency who designed the line:                                                                                                                                                                                             | RVPN                                  |
| 22. | Any Special consideration in design:                                                                                                                                                                                          | -                                     |



|     |                                                                                                                                                                        |                                                                                                                                                                                                                                       |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 23. | Details of last maintenance activity along with date:                                                                                                                  | Line Patrolling done on dt. 01.06.2024 to 30.06.2024.                                                                                                                                                                                 |
| 24. | Power flow in the line prior to failure:                                                                                                                               | 60 MW Jodhpur /99 MW Merta                                                                                                                                                                                                            |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | No                                                                                                                                                                                                                                    |
| 26. | Condition of foundation after failure:                                                                                                                                 | 04 Nos. Damage 01 Nos OK                                                                                                                                                                                                              |
| 27. | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Heavy Rain ,wind Storm & lightning                                                                                                                                                                                                    |
| 28. | Probable cause of failure:                                                                                                                                             | Heavy Rain ,wind Storm & lightning                                                                                                                                                                                                    |
| 29. | Details of previous failure of the line / tower :                                                                                                                      | Loc no. 135,168,169,175                                                                                                                                                                                                               |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                      | Still to be decide                                                                                                                                                                                                                    |
| 31. | Likely date of restoration:                                                                                                                                            | Yet to be decide                                                                                                                                                                                                                      |
| 32. | Present Status:                                                                                                                                                        |                                                                                                                                                                                                                                       |
| 33. | Details of any Tests carried out after failure(attach test reports):                                                                                                   | -                                                                                                                                                                                                                                     |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                                          | -                                                                                                                                                                                                                                     |
| 35. | Location of failed tower<br>a. Location Coordinates:<br>b. Nearest Airport:<br>c. District and State:                                                                  | a.476- '26°35'44.2"N '73°05'28.6" E<br>477- '26°35'33.0" N '73°05'33.4"E<br>478- '26°35'21.8" N, '73°05'38.3" E<br>479- '26°35'09.7" N '73°05'43.5" E<br>480- '26°34'58.1" N '73°05'48.5" E<br>b. Jodhpur<br>c. Jodhpur and Rajasthan |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower)                          |                                                                                                                                                                                                                                       |
| 37. | Tower weight:                                                                                                                                                          | 10.005 MT                                                                                                                                                                                                                             |
| 38. | Tower spotting data:                                                                                                                                                   | --                                                                                                                                                                                                                                    |
| 39. | Tower schedule of affected section:                                                                                                                                    | 4.6 KM                                                                                                                                                                                                                                |
| 40. | Sag tension calculation considered for design of tower:                                                                                                                | -                                                                                                                                                                                                                                     |
| 41. | Design document of failed towers:                                                                                                                                      | -                                                                                                                                                                                                                                     |
| 42. | Any other relevant information:                                                                                                                                        | -                                                                                                                                                                                                                                     |



## 4. MSPCL

The following Transmission Lines Towers of MSPCL had failed during January 2024 to December 2024

| Si. No. | Name of the Transmission Line | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone    | No. of Towers Failed |         |       | Conductor         |
|---------|-------------------------------|-----------------|-----------------|-----------------------|--------------|----------------------|---------|-------|-------------------|
|         |                               |                 |                 |                       |              | Suspension           | Tension | Total |                   |
| 4.1     | 400 kV Imphal – Thoubal Line  | MSPCL           | 24.04.2024      | 15.03.2021            | Not Provided | 3                    | 2       | 5     | 400 kV Moose ACSR |

### 4.1 400 kV Imphal – Thoubal Line

|   |                                                                                                                                                                                                                             |                                            |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| 1 | Name of Transmission line with voltage level:                                                                                                                                                                               | 400 kV Imphal – Thoubal Line               |
| 2 | Date and time of occurrence/discovery of failure                                                                                                                                                                            | 24/04/2024 ; 3:07 pm                       |
| 3 | Length of line (km):                                                                                                                                                                                                        | 45.11 Km                                   |
| 4 | Type of configuration: [(S/C, D/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                             | D/C                                        |
| 5 | Number of Towers and Type of Towers failed: [suspension/ tension/dead end/special tower/river crossing tower/ Powerline crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 5 (Five) Nos. DB+3, DC+0, DA+3, DA+0, DA+3 |



|    |                                                                         |                                                                                                                                           |
|----|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 6  | Tower location No. with reference to nearest substation(indicate Name): | Loc. No. 38A/0, Loc.<br>No. 39/0, Loc. No. 39/1, Loc. No. 39/2, Loc. No. 39/3<br>( Reference to 400/132 KV PGCI,<br>Yurembam Substation ) |
| 7  | Name and size of conductor:                                             | ACSR Moose Conductor ; Sectional Area: 597.2 sq mm; Overall<br>Diameter: 31.77 mm                                                         |
| 8  | No. of sub-conductors per bundle and bundle spacing:                    | -                                                                                                                                         |
| 9  | Number and size of Ground wire/OPGW (if provided):                      | -                                                                                                                                         |
| 10 | Type of insulators in use(Porcelain / Glass / Polymer):                 | Porcelain                                                                                                                                 |
| 11 | Configuration of insulators (I / V / Y / tension)                       | NA                                                                                                                                        |
| 12 | No. of insulators per string and No. of strings per phase:              | 23 nos. per string; 2 strings per Phase.                                                                                                  |
| 13 | Year of construction / commissioning:                                   | 15th March, 2021                                                                                                                          |
| 14 | Executing Agency:                                                       | M/s Shyama Power India Ltd.                                                                                                               |
| 15 | Weather condition on the date of failure:                               | Isolated cyclonic storm.                                                                                                                  |
| 16 | Terrain Category:                                                       | NA                                                                                                                                        |
| 17 | Reliability Level                                                       | NA                                                                                                                                        |
| 18 | Wind Zone (1/2/3/4/5/6) and velocity of wind:                           | NA                                                                                                                                        |
| 19 | Details of earthing of tower (pipe type/Counter poise):                 | Pipe type                                                                                                                                 |



|    |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                 |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20 | Line designed as per IS:802 (1977/1995/any other code):                                                                                                             | -                                                                                                                                                                                                                                                                                               |
| 21 | The agency who designed the line:                                                                                                                                   | -                                                                                                                                                                                                                                                                                               |
| 22 | Any Special consideration in design:                                                                                                                                | -                                                                                                                                                                                                                                                                                               |
| 23 | Details of last maintenance activity along with date                                                                                                                | Tightening of Jumper on 6th Mar 2024                                                                                                                                                                                                                                                            |
| 24 | Power flow in the line prior to failure:                                                                                                                            | -                                                                                                                                                                                                                                                                                               |
| 25 | Any missing member found before / after failure of towers:                                                                                                          | Not found                                                                                                                                                                                                                                                                                       |
| 26 | Condition of foundation after failure:                                                                                                                              | Foundation is OK.                                                                                                                                                                                                                                                                               |
| 27 | Brief Description of failure: alongwith photographs(if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | On 24th April 2024, at around 3:00 pm, cyclonic storm in the village Wahengkhuman had caused damaged to 400 KV Imphal-Thoubal line. Five towers were affected. (Three towers collapsed and two towers suffered structural damage). The Extent of damage to the tower and foundation is as under |
| 28 | Probable cause of failure:                                                                                                                                          | Cyclonic storm.                                                                                                                                                                                                                                                                                 |
| 29 | Details of previous failure of the line / tower :                                                                                                                   | No previous failure.                                                                                                                                                                                                                                                                            |
| 30 | Whetherline will be restored on ERS or Spare tower will be used:                                                                                                    | Spare tower will be used.                                                                                                                                                                                                                                                                       |
| 31 | Likely date of restoration:                                                                                                                                         | Line restored on 14th September 2024                                                                                                                                                                                                                                                            |



|    |                                                                                                                                              |                                                                                                                                                                                                                                              |
|----|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 32 | Present Status:                                                                                                                              | Active                                                                                                                                                                                                                                       |
| 33 | Details of any Tests carriedout after failure:                                                                                               | NA                                                                                                                                                                                                                                           |
| 34 | Wind speed data of date & time of failure from nearby authorised observatory:                                                                | NA                                                                                                                                                                                                                                           |
| 35 | Location of failed tower                                                                                                                     | NA                                                                                                                                                                                                                                           |
|    | a) Location Coordinates                                                                                                                      | <p>Loc. No.</p> <p>Coordinates</p> <p>Longitude Latitude</p> <p>38A/0 93°51'18.3" 24°40'27.3"</p> <p>39/0 93°51'23" 24°40'14.8"</p> <p>39/1 93°51'30" 24°40'7.3"</p> <p>39/2 93°51'39.2" 24°39'57.5"</p> <p>39/3 93°51'45.6" 24°39'50.6"</p> |
|    | b)Nearesh Airport:                                                                                                                           | Nearest Airport: Imphal International Airport                                                                                                                                                                                                |
|    | C) District and State:                                                                                                                       | Bishnupur, Manipur                                                                                                                                                                                                                           |
| 36 | Single Line diagram/clearance diagram of failed tower(s) with all diamensions(Horizontal & vertical dimensions including base width of tower | NA                                                                                                                                                                                                                                           |
| 37 | Tower weight:                                                                                                                                | NA                                                                                                                                                                                                                                           |
| 38 | Tower spotting data:                                                                                                                         | NA                                                                                                                                                                                                                                           |
| 39 | Tower scheduled of affected section                                                                                                          | NA                                                                                                                                                                                                                                           |



|    |                                                        |    |
|----|--------------------------------------------------------|----|
| 40 | Sag tension calculation considered for design of tower | NA |
| 41 | Design document of failed towers:                      | NA |
| 42 | Any other relevant information                         | NA |

**5. HVPNL**

The following Transmission Lines Towers of MSERCL had failed during January 2024 to December 2024

| Si. No. | Name of the Transmission Line              | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor         |
|---------|--------------------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|-------------------|
|         |                                            |                 |                 |                       |           | Suspension           | Tension | Total |                   |
| 5.1     | 220 kV D/C Sohna Road - Rangala Rajpurline | HVPNL           | 01.06.2024      | 2015                  | 4         | 3                    | 0       | 3     | 220 kV Moose ACSR |

**5.1 220 kV D/C Sohna Road -Rangala Rajpurline**

|     |                                                                                                                                                                                                                              |                                                                       |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                | 220 kV D/C Sohna Road -Rangala Rajpurline                             |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                            | 01.06.2024 at 16:35 Hrs                                               |
| 3.  | Length of line (km):                                                                                                                                                                                                         | 69.316 KM                                                             |
| 4.  | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                         | Double circuit towers                                                 |
| 5.  | Number of Towers and Type of Towers failed: [Suspension/tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | location 70, 71 & 72 (03 Nos) TATA design type Straight Tower, DA + 0 |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                      | Tower location no. 70.71 & 72 (from 220 KV Rangala Rajpur end)        |
| 7.  | Name and size of conductor:                                                                                                                                                                                                  | 0.5 Sg Inch ACSR Moose conductor                                      |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                         | 1                                                                     |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                           | OPGW 24 Fiber                                                         |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                      | procelain                                                             |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                           | I type                                                                |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                   | 15 Nos of Insulator per string and single string per phase            |
| 13. | Year of construction / commissioning:                                                                                                                                                                                        | Sep 2015                                                              |
| 14. | Executing Agency:                                                                                                                                                                                                            | M/s Shyama Power on turnkey mode                                      |



|     |                                                                                                                                                                        |                                                                                                                                                                                               |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15. | Weather condition on the date of failure:                                                                                                                              | Heavy whirl wind storm of high intensity                                                                                                                                                      |
| 16. | Terrain Category:                                                                                                                                                      | 2                                                                                                                                                                                             |
| 17. | Reliability Level:                                                                                                                                                     | 1                                                                                                                                                                                             |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                          | Zone IV (Velocity - 47 m/s)                                                                                                                                                                   |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                               | Pipe type                                                                                                                                                                                     |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                           | As per relevant IS:802-1995 (Old IS)                                                                                                                                                          |
| 21. | The agency who designed the line:                                                                                                                                      | M/s Shyama Power                                                                                                                                                                              |
| 22. | Any Special consideration in design:                                                                                                                                   | Nil                                                                                                                                                                                           |
| 23. | Details of last maintenance activity along with date:                                                                                                                  | From 14.04.2024 to 22.04.2024 maintenance of tower strengthening work has been carried out by providing missing member on this line being high theft prone area.                              |
| 24. | Power flow in the line prior to failure:                                                                                                                               | NIL (Line was charged only from Sohna Road                                                                                                                                                    |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | Few tower member were found missing. Also 2 to 3 no nuts & bolts were found missing from bottom of these towers.                                                                              |
| 26. | Condition of foundation after failure:                                                                                                                                 | Stubs / chimney of TL no. 70 found intact<br>Stubs / Chimney of both TL no. 71 & 72 found damaged. Need re-strengthening / re-stubbing after breaking of chimney up to depth of 1.5 - 2 Mtrs. |
| 27. | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Copy attached as Annexurei. (Committee report)                                                                                                                                                |
| 28. | Probable cause of failure:                                                                                                                                             | Heavy whirl wind storm of high Intensity and cascaded effect.                                                                                                                                 |
| 29. | Details of previous failure of the line / tower :                                                                                                                      | On the first time, 02 no. towers were collapsed during const, of line. Though same was not on record as the rectification/restoration work was done by the EPC contractor himself.            |



|     |                                                                                                                                               |                                                                                                                                                                                                                                                                                                                               |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                                                                                                                               | <p>. Second time on dated 29.05.2020, 05 no towers (A-type) were collapsed due to heavy windstorm (TL No. 118 to 120 were completely damaged &amp; 01 no. cross arm of TL No. 117 &amp; 121 damaged).</p> <p>. Third time on dated 26.04.2022, 01 no. tower (DD+9 type) was collapsed due to heavy windstorm (TL no. 139)</p> |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                             | Spare Towers                                                                                                                                                                                                                                                                                                                  |
| 31. | Likely date of restoration:                                                                                                                   | Line energized on 10.06.2024 by erecting spared towers.                                                                                                                                                                                                                                                                       |
| 32. | Present Status:                                                                                                                               | Line energized on 10.06.2024 by erecting spared towers.                                                                                                                                                                                                                                                                       |
| 33. | Details of any Tests carried out after failure(attach test reports):                                                                          | Sample sent to Delhi Test House / Azadpur.fNABL accredited authorized lab)                                                                                                                                                                                                                                                    |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                 | IMO / Gol Chandigarh cannot provide the wind speed data due to non-availability of observatory in Nuh District.                                                                                                                                                                                                               |
| 35. | Location of failed tower<br>a. Location Coordinates:<br>b. Nearest Airport:<br>c. District and State:                                         | <p>TL No. 70: Latitude - 27.9704550. Longitude - 77.0146410</p> <p>TL no. 71:Latitude - 27.972465, Longitude - 77.014655</p> <p>TL no. 72:Latitude - 27.974552, Longitude -77.013362</p> <p>IGI New Delhi</p> <p>NUH Mewat Haryana</p>                                                                                        |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Attached herewith                                                                                                                                                                                                                                                                                                             |
| 37. | Tower weight:                                                                                                                                 | 3949.40 kg (DA type TATA tower) + 178.25 Kg (Stub) =.4127.65 kg (per Tower)                                                                                                                                                                                                                                                   |
| 38. | Tower spotting data:                                                                                                                          | Not available being old design                                                                                                                                                                                                                                                                                                |
| 39. | Tower schedule of affected section:                                                                                                           | Attached                                                                                                                                                                                                                                                                                                                      |



|     |                                                         |                                                                                                                                                                                                |
|-----|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 40. | Sag tension calculation considered for design of tower: | Attached                                                                                                                                                                                       |
| 41. | Design document of failed towers:                       | Not available being old design                                                                                                                                                                 |
| 42. | Any other relevant information:                         | PGCIL & RVPNL lines are also passing in vicinity of Nuh (Mewat) region and they are also facing same issues in their tower like cutting of tower members by focal peoples through gas cutters. |



## 6. MPPTCL

The following Transmission Lines Towers of MPPTCL had failed during January 2024 to December 2024

| Si. No. | Name of the Transmission Line                                                          | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone    | No. of Towers Failed |         |       | Conductor                                           |
|---------|----------------------------------------------------------------------------------------|-----------------|-----------------|-----------------------|--------------|----------------------|---------|-------|-----------------------------------------------------|
|         |                                                                                        |                 |                 |                       |              | Suspension           | Tension | Total |                                                     |
| 6.1     | 220kV Rewa (220 kV) -Rewa (RUMSP) ckt-I & ckt-II & 220 kV Sidhi (RUMSP) ckt-I & ckt-II | MPPTCL          | 19.05.2024      | 23.09.2022            | Not Provided | 1                    | 0       | 1     | 220 kV Single Zebra HTLS / 220 kV Single ACSR Zebra |
| 6.2     | 400kV DCDS Malwa TPH (SSTPH)- Pithampur Ckt. I & II line                               | MPPTCL          | 26.05.2024,     | 2013                  | 3            | 8                    | 1       | 9     | 400 kV Twin Moose ACSR                              |
| 6.3     | 220kV Satna (220 kv) - Rewa & 220 kv Satna – Manpur (Adani) line                       | MPPTCL          | 17.06.2024      | 06.04.1991            | Not Provided | 1                    | 0       | 1     | 220 kV Single Zebra ACSR                            |



## 6.1 220kV Rewa (220 kV) -Rewa (RUMSP) ckt-I & ckt-II & 220 kV Sidhi (RUMSP) ckt-I & Ckt II:

|    |                                                                                                                                                                                                                            |                                                                                        |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1  | Name of Transmission line with voltage level                                                                                                                                                                               | 220kV Rewa (220 kV) -Rewa (RUMSP) ckt-I & ckt-II & 220 kV Sidhi (RUMSP) ckt-I & ckt-II |
| 2  | Date and time of occurrence/discovery of Failure                                                                                                                                                                           | :19.05.2024 Time 17:03 Hrs/17:07 hrs.                                                  |
| 3  | Length of line (Km)                                                                                                                                                                                                        | : 32.33 km.                                                                            |
| 4  | Type of configuration [S/C, D/C, M/C, S/C Strung on D/C towers, narrow base etc.]                                                                                                                                          | : M/C                                                                                  |
| 5  | Numbers of Towers & type of Towers failed [Suspension/ tension/ dead end/ special tower/river crossing tower/ power line crossing/Railway Crossing etc. with/ without extension (indicate the type & length of extension)] | : 01 (MC0+3) suspension                                                                |
| 6  | Tower location No. with reference to nearest substation (indicate Name)                                                                                                                                                    | : Loc. No. 115 (MC0+3) ,220 kV S/s Rewa                                                |
| 7  | Name & size of conductor                                                                                                                                                                                                   | HTLS Zebra & ACSR Zebra                                                                |
| 8  | No. of sub-conductor per bundle and bundle spacing                                                                                                                                                                         | : Single HTLS/ Single ACSR Zebra                                                       |
| 9  | Number and size of Ground wire/POGW (if provided)                                                                                                                                                                          | : 12.50 MM, OPGW                                                                       |
| 10 | Type of insulator in use (porcelain)/Glass/polymer                                                                                                                                                                         | : Polymer/ Insulator                                                                   |
| 11 | Configuration of Insulators (I/V/Y tension)                                                                                                                                                                                | : I suspension                                                                         |
| 12 | No. of Insulators per string and no. of strings per phase                                                                                                                                                                  | : 01 No. insulators per strings per phase                                              |



|    |                                                                                                                                       |                                                                                                                        |
|----|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 13 | Year of construction/ commissioning                                                                                                   | : 21.09.2022 both ckt./ 06.06.2022 & Load Taken on dt. 23.09.2022                                                      |
| 14 | Executing Agency                                                                                                                      | : MPPTCL                                                                                                               |
| 15 | Weather condition on the date failure                                                                                                 | : Heavy storm and rain                                                                                                 |
| 16 | Terrain Category                                                                                                                      | : Flat hill                                                                                                            |
| 17 | Reliability Level                                                                                                                     | : 00                                                                                                                   |
| 18 | Details of earthing of tower (pipe type/ couter poise)                                                                                | :Counter poise                                                                                                         |
| 19 | Line Designed as per IS:802 (1977/1995/ any other code)                                                                               | :                                                                                                                      |
| 20 | The agency who designed the line                                                                                                      | :                                                                                                                      |
| 21 | Any Special consideration in design                                                                                                   | :                                                                                                                      |
| 22 | Details of last maintenance activity along with date: Routine patrolling                                                              | :10.05.2024                                                                                                            |
| 23 | Power flow in the line prior to failure                                                                                               |                                                                                                                        |
| 24 | Any missing member found before/after failure of towers                                                                               | : Cleat & plate of 03 No legs' were stolen                                                                             |
| 25 | Condition of foundation after failure                                                                                                 | : Foundation was robust, only 1 No stub found bend due to tower collapse.                                              |
| 26 | Brief Description of failure                                                                                                          | : Tower Jointing Cleat & Plates were Stolen and during heavy storm in that area tower was collapsed.                   |
| 27 | [alongwith photographs (if available), other related information like tower schedule, newspaper clipping for cyclone/ wind storm etc. | : News Papers clippings are attached.                                                                                  |
| 28 | Probable cause of failure                                                                                                             | : Due to heavy wind and thunder across the line and due to missing cleate and plate are main causes of tower collapse. |



|    |                                                                                                                                                  |                                                                                       |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 29 | Details of previous failure of the line/tower                                                                                                    | : No Installation of ERS was not possible                                             |
| 30 | Whether line will be restored on ERS or Spare tower will be used                                                                                 | : Re-erection of tower at same location.                                              |
| 31 | Likely date of restoration                                                                                                                       | : Restored on dt. 27.05.2024                                                          |
| 32 | Present status- Line (4 ckt) Charged after repairing 140 bend stub & Erection of New super structure ( MC0+3 Mtr)                                | : Charged on dt. 27.05.2024.                                                          |
| 33 | Details of any Tests carried out after failure ( Attatch test reports)                                                                           | : Sample of damage tower parts will be send to testing lab, MP Laghu Udyog Nigam Ltd. |
| 34 | Wind speed data of date & time of failure from nearby authorised observatory                                                                     | :                                                                                     |
| 35 | Location of failed tower                                                                                                                         | : 115 (MC0+3 Mtr)                                                                     |
| 36 | Location coordinates                                                                                                                             | : 24.487663/81.556443                                                                 |
| 37 | Nearest airport                                                                                                                                  | : Prayagraj (U.P.)                                                                    |
| 38 | District & state                                                                                                                                 | : Rewa/Madhya Pradesh.                                                                |
| 39 | Single line diagram/clearance diagram of failed tower(s) with all diamentions ( horizontal & vertical diamentions including base width of tower) | :                                                                                     |
| 40 | Tower weight                                                                                                                                     | : 12067 kgs.                                                                          |
| 41 | Tower spotting data                                                                                                                              | :                                                                                     |
| 42 | Tower schedule of affected section                                                                                                               | : enclosed                                                                            |
| 43 | Sag tension calculation considered for design of tower                                                                                           | :                                                                                     |
| 44 | Design document of failed towers                                                                                                                 | :                                                                                     |
| 45 | Any other relevant information                                                                                                                   | :                                                                                     |

**6.2 400 kV DCDS Malwa TPH (SSTPH)- Pithampur Ckt. I & II line**

|    |                                                                                                                                         |                                                                                                                                                                                                                                                                           |
|----|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Name of Transmission line with voltage level                                                                                            | 400kV DCDS Malwa TPH (SSTPH)- Pithampur Ckt. I & II line                                                                                                                                                                                                                  |
| 2  | Date and time of occurrence/discovery of Failure                                                                                        | 26.05.2024, at 16:15 Hrs                                                                                                                                                                                                                                                  |
| 3  | Length of line (Km)                                                                                                                     | 136 KM                                                                                                                                                                                                                                                                    |
| 4  | Type of configuration                                                                                                                   | DCDS                                                                                                                                                                                                                                                                      |
|    | [S/C,D/C,S/C String on D/C towers, narrow base etc.]                                                                                    | DC                                                                                                                                                                                                                                                                        |
| 5  | [Suspension/ tension/ dead end/ special tower/river crossing tower/ power line crossing/ Railway Crossing etc. with/ without extension. | 1) 04 Nos Suspension towers collapsed [178 (FD0), 179 (FD0+6), 180 (FD0) & 181 (FD0) ]<br>2) 04 Nos Suspension Partially Damaged [177 (FD0),182 (FDO),183(FD0) & 22(FD0+6)] 3)01 no Tension Partially Damaged [176 (FD30)<br>Total 08 no Suspension & 01 no Tension tower |
| 6  | Tower location No. with reference to nearest substation {indicate Name}                                                                 | Loc No. 22 & 176 is situated at 400kV Pithampur Sub-Station                                                                                                                                                                                                               |
| 7  | Name and size of conductor                                                                                                              | Name -Twin Moose ACSR conductor size- 31.80 mm dia                                                                                                                                                                                                                        |
| 8  | No. of sub-conductor per bundle and bundle spacing                                                                                      | 02 No conductor per bundle                                                                                                                                                                                                                                                |
| 9  | Number and size of Ground wire/POGW (if provided)                                                                                       | 7/3.66 mm, GI GW and OPGW                                                                                                                                                                                                                                                 |
| 10 | Type of insulator in use (porcelain)/Glass/polymer                                                                                      | Porcelain                                                                                                                                                                                                                                                                 |
| 11 | Configuration of Insulators (I/V/Y tension)                                                                                             | I Type                                                                                                                                                                                                                                                                    |
| 12 | No. of Insulators per string and no. of strings per phase                                                                               | 23 No. & 01 no. string per phase in suspension tower and 24 No. & 02 no strings per phase in tension tower                                                                                                                                                                |
| 13 | Year of construction/ commissioning                                                                                                     | Year - 2013                                                                                                                                                                                                                                                               |



|    |                                                                                                                                                                    |                                                                      |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| 14 | Executing Agency                                                                                                                                                   | MPPTCL                                                               |
| 15 | Weather condition on the date failure                                                                                                                              | Cyclonic storm in local side area                                    |
| 16 | Terrain Category                                                                                                                                                   | Agriculture and Hill area                                            |
| 17 | Reliability Level                                                                                                                                                  | Not available                                                        |
| 18 | Wind zone (1/2/3/4/5/6) and velocity of wind                                                                                                                       | Wind Zone 3                                                          |
| 19 | Details of earthing of tower (pipe type/ counter poise)                                                                                                            | Rod earthing                                                         |
| 20 | line Designed as per IS:802 (1977/1995/2015 any other code)                                                                                                        | 1977                                                                 |
| 21 | The agency who designed the line                                                                                                                                   | SAE India Ltd.                                                       |
| 22 | Any Special consideration in design                                                                                                                                | Strengthening of towers structure are proposed                       |
| 23 | Details of last maintenance activity along with date                                                                                                               | Ground patrolling done on date 17.05.2024                            |
| 24 | Power flow in the line prior to failure                                                                                                                            | Both circuits of Line was in operation.                              |
| 25 | Any missing member found before/after failure of towers                                                                                                            | No missing member                                                    |
| 26 | Condition of foundation after failure before Description of Failure                                                                                                | Foundation OK ,04 Nos. tower collapse tower stub damaged             |
| 27 | Brief Description of Failure [ along with photography (if available) other related information like tower schedule, newspaper clipping or cyclone/ wind storm etc. | Enclosed with detailed report                                        |
| 28 | Probable cause of failure                                                                                                                                          | Cyclonic storm in local side area                                    |
| 29 | Details of previous failure of the line/tower                                                                                                                      | Heavy wind and storm                                                 |
| 30 | whether line will be restored on ERS or Spare tower will be used                                                                                                   | Yes, possibilities are being checked for restoration of tower on ERS |
| 31 | Likely date of restoration                                                                                                                                         | Up to last week of June 2024                                         |
| 32 | Present status                                                                                                                                                     | Rectification is under progress                                      |
| 33 | Details of any Tests carried out after failure                                                                                                                     | Mechanical & Chemical test of tower part will be carried out         |



|    |                                                                                                                                               |                                                                                                                                                            |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 34 | wind speed data of date & time of failure from nearby authorized observatory                                                                  | NA                                                                                                                                                         |
| 35 | Location of failed tower                                                                                                                      | 4 Nos towers collapsed [177 (FD0), 178 (FD0), 179 (FD0+6), 180 (FD0) ,181 (FD0) & 182 (FDO)]<br>03 Nos Partially Damaged [176 (FD30),183(FD0) & 22(FD0+6)] |
|    | a. Location coordinates                                                                                                                       | List enclosed.                                                                                                                                             |
|    | b. Nearest Airport                                                                                                                            | Indore                                                                                                                                                     |
|    | c. District and State                                                                                                                         | Khargone ( M.P.)                                                                                                                                           |
| 36 | Single line diagram/clearance diagram of failed tower(s) with all dimensions (Horizontal & Vertical dimensions including base width of tower) | Enclosed                                                                                                                                                   |
| 37 | Tower weight                                                                                                                                  | Superstructure (9.173 MT)                                                                                                                                  |
| 38 | Tower Spotting data                                                                                                                           | Nil                                                                                                                                                        |
| 39 | Tower schedule of affected section                                                                                                            | Enclosed                                                                                                                                                   |
| 40 | Sag tension calculation considered for design of tower                                                                                        | with in limit                                                                                                                                              |
| 41 | Design document of failed towers                                                                                                              | NA                                                                                                                                                         |
| 42 | Any other relevant information                                                                                                                | NA                                                                                                                                                         |

**6.3 220 kV Satna (220 kv) - Rewa & 220 kv Satna – Manpur (Adani) line**

|    |                                                                                                                                                                                                                            |                                                                  |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 1  | Name of Transmission line with voltage level                                                                                                                                                                               | 220kV Satna (220 kv) - Rewa & 220 kv Satna – Manpur (Adani) line |
| 2  | Date and time of occurrence/discovery of Failure                                                                                                                                                                           | :17.06.2024 Time 17:05 Hrs /17:06 hrs.                           |
| 3  | Length of line (Km)                                                                                                                                                                                                        | :48.48 km. (Under tlm Satna)                                     |
| 4  | Type of configuration [S/C, D/C, M/C, S/C Strung on D/C towers, narrow base etc.]                                                                                                                                          | : D/C                                                            |
| 5  | Numbers of Towers & type of Towers failed [Suspension/ tension/ dead end/ special tower/river crossing tower/ power line crossing/Railway Crossing etc. with/ without extension (indicate the type & length of extension)] | : 01 (A0) suspension                                             |
| 6  | Tower location No. with reference to nearest substation (indicate Name)                                                                                                                                                    | : Loc.No.70 (A0) ,220 kV S/s Satna                               |
| 7  | Name & size of conductor                                                                                                                                                                                                   | ACSR Zebra                                                       |
| 8  | No. of sub-conductor per bundle and bundle spacing                                                                                                                                                                         | : Single ACSR Zebra                                              |
| 9  | Number and size of Ground wire/OPGW (if provided)                                                                                                                                                                          | : 12.50 MM, OPGW                                                 |
| 10 | Type of insulator in use (porcelain)/Glass/polymer                                                                                                                                                                         | : Disc Insulator                                                 |
| 11 | Configuration of Insulators (I/V/Y tension)                                                                                                                                                                                | : I suspension                                                   |
| 12 | No. of Insulators per string and no. of strings per phase                                                                                                                                                                  | : 02 No. insulators per strings per phase                        |
| 13 | Year of construction/ commissioning                                                                                                                                                                                        | : 06.04.1991                                                     |
| 14 | Executing Agency                                                                                                                                                                                                           | : MPPTCL                                                         |
| 15 | Weather condition on the date failure                                                                                                                                                                                      | : Heavy storm and rain                                           |
| 16 | Terrain Category                                                                                                                                                                                                           | : Hill                                                           |
| 17 | Reliability Level                                                                                                                                                                                                          | : 00                                                             |
| 18 | Details of earthing of tower (pipe type/ counter poise)                                                                                                                                                                    | :Counter poise                                                   |
| 19 | Line Designed as per IS:802 (1977/1995/ any other code)                                                                                                                                                                    | : Not available                                                  |
| 20 | The agency who designed the line                                                                                                                                                                                           | MPEB Jabalpur                                                    |
| 21 | Any Special consideration in design                                                                                                                                                                                        | : Not available                                                  |



|    |                                                                                                                                               |                                                                                                                    |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 22 | Details of last maintenance activity along with date: Routine patrolling                                                                      | :10.05.2024                                                                                                        |
| 23 | Power flow in the line prior to failure                                                                                                       | 105 MW                                                                                                             |
| 24 | Any missing member found before/after failure of towers                                                                                       | NO                                                                                                                 |
| 25 | Condition of foundation after failure                                                                                                         | : Foundation was robust, only 2 No stub found bend due to tower collapse.                                          |
| 26 | Brief Description of failure                                                                                                                  | : Heavy storm in that area therefore tower has been collapsed.                                                     |
| 27 | [along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone/ wind storm etc.        | : Not available                                                                                                    |
| 28 | Probable cause of failure                                                                                                                     | : Due to heavy wind and thunder across the line .                                                                  |
| 29 | Details of previous failure of the line/tower                                                                                                 | : Not available                                                                                                    |
| 30 | Whether line will be restored on ERS or Spare tower will be used                                                                              | : Re-erection of tower at same location.                                                                           |
| 31 | Likely date of restoration                                                                                                                    | : Restored on dt. 22.06.2024                                                                                       |
| 32 | Present status- Line (4 ckt) Charged after repairing 140 bend stub & Erection of New super structure ( MCO+3 Mtr)                             | : Charged on dt. 22.06.2024.                                                                                       |
| 33 | Details of any Tests carried out after failure ( Attach test reports)                                                                         | : Test reports of Sample of damage tower has been Enclosed given by testing lab, MP Laghu Udyog Nigam Ltd.Jabalpur |
| 34 | Wind speed data of date & time of failure from nearby authorized observatory                                                                  | :No data available at O/o Deputy director of meteorological department Satan/Nagpur.                               |
| 35 | Location of failed tower                                                                                                                      | : 70 (A0)                                                                                                          |
| 36 | Location coordinates                                                                                                                          | 24.513489/80.916225                                                                                                |
| 37 | Nearest airport                                                                                                                               | : Rewa (M.P.)                                                                                                      |
| 38 | District & state                                                                                                                              | : Satna/Madhya Pradesh.                                                                                            |
| 39 | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | : Not available                                                                                                    |
| 40 | Tower weight                                                                                                                                  | : 4750 kgs.                                                                                                        |
| 41 | Tower spotting data                                                                                                                           | : Not available                                                                                                    |
| 42 | Tower schedule of affected section                                                                                                            | : Enclosed                                                                                                         |



|    |                                                        |                                                 |
|----|--------------------------------------------------------|-------------------------------------------------|
| 43 | Sag tension calculation considered for design of tower | : Not available                                 |
| 44 | Design document of failed towers                       | : Not available                                 |
| 45 | Any other relevant information                         | : No data has been available of A0 Tower in P&D |



## 7. Delhi Transco

The following Transmission Lines Towers of Delhi Transco had failed during January 2024 to December 2024

| Si. No. | Name of the Transmission Line           | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor  |
|---------|-----------------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|------------|
|         |                                         |                 |                 |                       |           | Suspension           | Tension | Total |            |
| 10.1    | 220 kV Kashmere Gate-South of Wazirabad | DTL             | 29.12.2024      | 1992                  | 4         | 1                    | 0       | 1     | ACSR Zebra |

### 7.1- 220 kV Transmission tower failure reports - 220 kV Kashmere Gate-South of Wazirabad

|    |                                                         |                                         |
|----|---------------------------------------------------------|-----------------------------------------|
| 1  | Name of Transmission Line with Voltage Level            | 220 kV Kashmere Gate-South of Wazirabad |
| 2  | Date and Time of occurrence/discovery of failure        | 29.12.2024 & 13:07 Hours                |
| 3  | Length of line(kM)                                      | 5.34                                    |
| 4  | Type of Configuration                                   | Double Circuit                          |
| 5  | Number of Towers and type of Towers Failed              | One Number, Suspension Tower            |
| 6  | Tower Location No. with reference to nearest substation | Tower No. 15                            |
| 7  | Name and size of conductor                              | ACSR Zebra                              |
| 8  | No. of sub-conductors as per bundle and bundle spacing  | N/A                                     |
| 9  | Number and size of Ground wire/OPGW                     | One Number,                             |
| 10 | Type of insulators in use                               | Porcelain                               |
| 11 | Configuration of Insulators                             | I                                       |
| 12 | No. of insulators per string and No. of strings         | 15 & 6                                  |



|    |                                                                              |                                      |
|----|------------------------------------------------------------------------------|--------------------------------------|
| 13 | Year of Construction/Commissioning                                           | 1992                                 |
| 14 | Executing Agency                                                             | DTL                                  |
| 15 | Weather condition on the date of failure                                     | Foggy                                |
| 16 | Terrain Category                                                             | Quaternary Alluvium                  |
| 17 | Reliability Level                                                            |                                      |
| 18 | Wind Zone(1/2/3/4/5/6) and velocity of wind                                  | 4 & 47m/s                            |
| 19 | Details of earthing of Tower                                                 | Pipe Type                            |
| 20 | Line designated as per IS:802                                                | IS:802 1977                          |
| 21 | The agency who designed the line                                             | DTL                                  |
| 22 | Any Special consideration in design                                          | N/A                                  |
| 23 | Details of last maintenance activity along with date                         | General maintenance of tower         |
| 24 | Power flow in the line prior to failure                                      | 69 MW                                |
| 25 | Any missing member found before/after failure of towers                      | NIL                                  |
| 26 | Condition of foundation after failure                                        | Similar to pre-failure               |
| 27 | Brief description of failure                                                 | Tower collapsed above the body level |
| 28 | Probable cause of failure                                                    | Localize Whirl wind                  |
| 29 | Details of previous failure of the line/Tower                                | 2014                                 |
| 30 | Whether line will be restored on ERS of spare tower will be used             | Spare tower shall be used            |
| 31 | Likely date of Restoration                                                   | 20.01.2025                           |
| 32 | Present Status                                                               | Temporary restoration initiated      |
| 33 | Details of any Tests carried out after failure                               | NIL                                  |
| 34 | Wind speed date of date & Time of failure from nearby authorized observatory | 4.1 km/h                             |
| 35 | Location of failed tower                                                     |                                      |



|    |                                                                                                                                             |                                                   |
|----|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| a  | Location Coordinates                                                                                                                        | 28°40'52.9"N 77°15'12.3"E                         |
| b  | Nearest Airport                                                                                                                             | IGI                                               |
| c  | District and State                                                                                                                          | Delhi                                             |
| 36 | Single line diagram/clearance diagram of failed tower(s) with all dimension(horizontal & Vertical dimensions including base width of tower) | Sag Template attached with hard copy              |
| 37 | Tower Weight                                                                                                                                | 3.57 Ton                                          |
| 38 | Tower Spotting Data                                                                                                                         |                                                   |
| 39 | Tower schedule of affected section                                                                                                          | Shall be provide seperately in due course of time |
| 40 | Sag tension calculation considered for design of tower                                                                                      | Sag Template attached                             |
| 41 | Design document of failed towers                                                                                                            | Shall be provide seperately in due course of time |
| 42 | Any other relevant information                                                                                                              | NIL                                               |



## 8. DVC

The following Transmission Lines Towers of DVC had failed during January 2024 to December 2024

| Si. No. | Name of the Transmission Line                          | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor                |
|---------|--------------------------------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|--------------------------|
|         |                                                        |                 |                 |                       |           | Suspension           | Tension | Total |                          |
| 11.1    | 220 kV D/C Line 203 & 204 (CTPS-DHANBAD)               | DVC             | 08.05.2024      | 1997                  | 5         | 2                    | 0       | 2     | 220 kV Single Zebra ACSR |
| 11.2    | 400 kV L#407, 408 (400KV D/C RTPS-Ranchi T/L) Ckt 2, 3 | DVC             | 30.05.2024      | 30.08.2017            | 4         | 1                    | 0       | 1     | 400 kV Quad Moose ACSR   |

### 8.1 220 kV D/C Line 203 & 204 (CTPS-DHANBAD)

|     |                                                                                                                                                                                                                               |                                                       |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                 | 220 kV D/C Line 203 & 204 (CTPS-DHANBAD)              |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                             | 08/05/2024 at 09:14 HRS                               |
| 3.  | Length of line (km):                                                                                                                                                                                                          | 45 KM                                                 |
| 4.  | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                          | D/C                                                   |
| 5.  | Number of Towers and Type of Towers failed: [Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 2 NO OF A+3 suspension tower                          |
| 6.  | Tower location No. with reference to nearest substation (indicate Name):                                                                                                                                                      | Location no 34 & 35, near to CTPS PLANT approx. 10 km |
| 7.  | Name and size of conductor:                                                                                                                                                                                                   | ACSR ZEBRA (54+7/3.18)                                |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                          | 1                                                     |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                            | OPGW ( 12.1 MM)                                       |
| 10. | Type of insulators in use (Porcelain / Glass / Polymer):                                                                                                                                                                      | PORCELAIN                                             |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                            | I                                                     |



|     |                                                                                                                                                                        |                                                                                       |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                             | 14                                                                                    |
| 13. | Year of construction / commissioning:                                                                                                                                  | 1997                                                                                  |
| 14. | Executing Agency:                                                                                                                                                      | DVC                                                                                   |
| 15. | Weather condition on the date of failure:                                                                                                                              | STORMY                                                                                |
| 16. | Terrain Category:                                                                                                                                                      | RIVER                                                                                 |
| 17. | Reliability Level:                                                                                                                                                     | Normal                                                                                |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                          | 5                                                                                     |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                               | PIPE                                                                                  |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                           |                                                                                       |
| 21. | The agency who designed the line:                                                                                                                                      | DVC                                                                                   |
| 22. | Any Special consideration in design:                                                                                                                                   | NA                                                                                    |
| 23. | Details of last maintenance activity along with date:                                                                                                                  | TREE TRIMMING HAS BEN DONE ON 08 TH APRIL                                             |
| 24. | Power flow in the line prior to failure:                                                                                                                               | 64 MVA                                                                                |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | NO                                                                                    |
| 26. | Condition of foundation after failure:                                                                                                                                 | DAMAGED                                                                               |
| 27. | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | PHOTOGRAPH ATTACHED                                                                   |
| 28. | Probable cause of failure:                                                                                                                                             | May be due to be unprecedented high wind at the time of incident.                     |
| 29. | Details of previous failure of the line / tower :                                                                                                                      | NO                                                                                    |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                      | ERS HAS BEE USED FOR ONE CKT 203                                                      |
| 31. | Likely date of restoration:                                                                                                                                            | 15 TH JULY 2024                                                                       |
| 32. | Present Status:                                                                                                                                                        | Both CKT are normalized through New Tower                                             |
| 33. | Details of any Tests carried out after failure(attach test reports):                                                                                                   | NA                                                                                    |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                                          | NA                                                                                    |
| 35. | Location of failed tower<br>a. Location Coordinates:<br>b. Nearest Airport:<br>c. District and State:                                                                  | a. Lat 23.806244°<br>Long 86.163303°<br>b. Durgapur, Airport<br>c. Dhanbad, Jharkhand |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical                                                                    | NA                                                                                    |



|     |                                                         |          |
|-----|---------------------------------------------------------|----------|
|     | dimensions including base width of tower)               |          |
| 37. | Tower weight:                                           | 5.127 MT |
| 38. | Tower spotting data:                                    | NA       |
| 39. | Tower schedule of affected section:                     | NA       |
| 40. | Sag tension calculation considered for design of tower: | NA       |
| 41. | Design document of failed towers:                       | NA       |
| 42. | Any other relevant information:                         | NA       |

## 8.2 400 kV L#407,408 (400 kV D/C RTPS- Ranchi T/L) Ckt 2, 3

|    |                                                                                                                                                                                                                              |                                                          |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| 1. | Name of Transmission line with voltage level:                                                                                                                                                                                | 400 kV L#407, 408 (400KV D/C RTPS-Ranchi T/L) Ckt 2, 3   |
| 2. | Date and time of occurrence/discovery of failure:                                                                                                                                                                            | 20:14 Hrs on 30.05.2024                                  |
| 3. | Length of line (km):                                                                                                                                                                                                         | 155.16 KM                                                |
| 4. | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                         | D/C                                                      |
| 5. | Number of Towers and Type of Towers failed: [Suspension/tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | One no. tower 400KV (DA+0) type tower at location no.195 |
| 6. | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                      | location no.195 , Purulia Substation                     |
| 7. | Name and size of conductor:                                                                                                                                                                                                  | Quad ACSR Moose, size:54/3.53 mm AL, 7/3.53mm Steel      |
| 8. | No. of sub-conductors per                                                                                                                                                                                                    | 4nos. Spacer: 457 mm                                     |



|     |                                                              |                                                         |
|-----|--------------------------------------------------------------|---------------------------------------------------------|
|     | bundle and bundle spacing:                                   |                                                         |
| 9.  | Number and size of Ground wire/OPGW (if provided):           | Earth Wire. No: 2, Size: 7/3.66 mm.                     |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):      | Porcelain                                               |
| 11. | Configuration of insulators (I / V / Y / tension):           | I                                                       |
| 12. | No. of insulators per string and No. of strings per phase:   | 24nos. of insulators per string and 4 string per phase. |
| 13. | Year of construction / commissioning:                        | 30.08.2017                                              |
| 14. | Executing Agency:                                            | M/s Jyoti Structures Limited                            |
| 15. | Weather condition on the date of failure:                    | High Speed Norwester Wind                               |
| 16. | Terrain Category:                                            | Plain                                                   |
| 17. | Reliability Level:                                           | Normal                                                  |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                | 4, Velocity: 30-40 KM per Hour                          |
| 19. | Details of earthing of tower (pipe type/ Counter poise):     | Pipe Type                                               |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code): | As per relevant IS Standard                             |
| 21. | The agency who designed the line:                            | M/s Jyoti Structures Limited                            |
| 22. | Any Special consideration in design:                         | Normal                                                  |
| 23. | Details of last maintenance activity along with date:        | Regular Patrolling                                      |
| 24. | Power flow in the line prior to failure:                     | 124MW                                                   |



|       |                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |          |                                                                                                                |              |                                                                                                         |       |          |                                                                                                                                                                             |              |                                                                                                |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|----------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------|-------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------|
| 25    | Any missing member found before / after failure of towers:                                                                                                             | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |          |                                                                                                                |              |                                                                                                         |       |          |                                                                                                                                                                             |              |                                                                                                |
| 26    | Condition of foundation after failure:                                                                                                                                 | No damage in Foundation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |          |                                                                                                                |              |                                                                                                         |       |          |                                                                                                                                                                             |              |                                                                                                |
| 27    | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | <p>400KV D/C RTPS-Ranchi L#407/408 tripped at 20:14 Hrs on 30.05.2024</p> <p>Relay indication of RTPS end are as follows:</p> <table> <tr> <td rowspan="2">L#407</td><td>M1 (ABB)</td><td>Zone-1, R-ph and Y-ph, carrier aided trip, Fault Current: R-ph-4196.07A, Fault Loop:-L1-N, fault Distance: N/A</td></tr> <tr> <td>M2 (Siemens)</td><td>Zone-1, r-ph &amp; Y-ph fault, Fault Current: R-ph-4.41KA, Fault Loop: L1/E, Fault Distance: 92.7KM (59.6%)</td></tr> <tr> <td rowspan="2">L#408</td><td>M1 (ABB)</td><td>Zone-1, R-ph, Y-ph and B-ph, carrier aided trip, Fault Current: R-ph-6182.75A, Y-ph-8527.74A, B-ph-6878.42A, Fault Loop:-L1-N, L2-N, L3-N, fault Distance:61.25K M (39.39%)</td></tr> <tr> <td>M2 (Siemens)</td><td>Zone-1, R-ph ,Y-ph and B-ph fault, Fault Current: R-ph-6.14kA, Y-ph-8.48kA, B-ph-6.97kA, Fault</td></tr> </table> | L#407 | M1 (ABB) | Zone-1, R-ph and Y-ph, carrier aided trip, Fault Current: R-ph-4196.07A, Fault Loop:-L1-N, fault Distance: N/A | M2 (Siemens) | Zone-1, r-ph & Y-ph fault, Fault Current: R-ph-4.41KA, Fault Loop: L1/E, Fault Distance: 92.7KM (59.6%) | L#408 | M1 (ABB) | Zone-1, R-ph, Y-ph and B-ph, carrier aided trip, Fault Current: R-ph-6182.75A, Y-ph-8527.74A, B-ph-6878.42A, Fault Loop:-L1-N, L2-N, L3-N, fault Distance:61.25K M (39.39%) | M2 (Siemens) | Zone-1, R-ph ,Y-ph and B-ph fault, Fault Current: R-ph-6.14kA, Y-ph-8.48kA, B-ph-6.97kA, Fault |
| L#407 | M1 (ABB)                                                                                                                                                               | Zone-1, R-ph and Y-ph, carrier aided trip, Fault Current: R-ph-4196.07A, Fault Loop:-L1-N, fault Distance: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       |          |                                                                                                                |              |                                                                                                         |       |          |                                                                                                                                                                             |              |                                                                                                |
|       | M2 (Siemens)                                                                                                                                                           | Zone-1, r-ph & Y-ph fault, Fault Current: R-ph-4.41KA, Fault Loop: L1/E, Fault Distance: 92.7KM (59.6%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |          |                                                                                                                |              |                                                                                                         |       |          |                                                                                                                                                                             |              |                                                                                                |
| L#408 | M1 (ABB)                                                                                                                                                               | Zone-1, R-ph, Y-ph and B-ph, carrier aided trip, Fault Current: R-ph-6182.75A, Y-ph-8527.74A, B-ph-6878.42A, Fault Loop:-L1-N, L2-N, L3-N, fault Distance:61.25K M (39.39%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |          |                                                                                                                |              |                                                                                                         |       |          |                                                                                                                                                                             |              |                                                                                                |
|       | M2 (Siemens)                                                                                                                                                           | Zone-1, R-ph ,Y-ph and B-ph fault, Fault Current: R-ph-6.14kA, Y-ph-8.48kA, B-ph-6.97kA, Fault                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       |          |                                                                                                                |              |                                                                                                         |       |          |                                                                                                                                                                             |              |                                                                                                |



|      |                                                                                                          |                                                                                                                                                                                                                                  |
|------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |                                                                                                          | <div> <div></div> <div></div> <div> Loop: L2-L3/E,<br/> Fault Distance:<br/> 67.1KM(43.2%) </div> </div> <p>Weather Condition: Heavy storm, Raining, thundering and lightning.</p> <p>Committee Report attached in the mail.</p> |
| 28 . | Probable cause of failure:                                                                               | There may be unprecedented high wind at the time of twisting and the twisting has been occurred perpendicular of the line as found by the Committee.                                                                             |
| 29 . | Details of previous failure of the line / tower :                                                        | No previous failure since commissioning of the line in the year 2016-17.                                                                                                                                                         |
| 30 . | Whether line will be restored on ERS or Spare tower will be used:                                        | New Tower erected                                                                                                                                                                                                                |
| 31 . | Likely date of restoration:                                                                              | 26.06.2024                                                                                                                                                                                                                       |
| 32 . | Present Status:                                                                                          | Tower erected on 26.06.2024                                                                                                                                                                                                      |
| 33 . | Details of any Tests carried out after failure(attach test reports):                                     | Chemical Analysis, Tensile Strength, Salt spray exposure test of DVC (GI Stub) panels for 1000h etc. were carried out at CSIR-NML, Jamshedpur. Detailed NML Test report attached.                                                |
| 34 . | Wind speed data of date & time of failure from nearby authorized observatory:                            | NA                                                                                                                                                                                                                               |
| 35 . | Location of failed tower<br>a. Location<br>Coordinates:<br>b. Nearest Airport:<br>c. District and State: | Loc No. 195<br>(a) 23.449N, 86.106E<br>(b) Ranchi<br>(c) Purulia, West Bengal                                                                                                                                                    |



|         |                                                                                                                                                                    |          |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 36<br>. | Single line<br>diagram/clearance<br>diagram of failed<br>tower(s) with all<br>dimensions<br>(horizontal & vertical<br>dimensions including<br>base width of tower) | NA       |
| 37<br>. | Tower weight:                                                                                                                                                      | 18.639MT |
| 38<br>. | Tower spotting data:                                                                                                                                               | Attached |
| 39<br>. | Tower schedule of<br>affected section:                                                                                                                             | Attached |
| 40<br>. | Sag tension<br>calculation<br>considered for design<br>of tower:                                                                                                   | Attached |
| 41<br>. | Design document of<br>failed towers:                                                                                                                               | Attached |
| 42<br>. | Any other relevant<br>information:                                                                                                                                 | NA       |



## 9. NTPC

The following Transmission Lines Towers of NTPC had failed during January 2024 to December 2024

| Si. No. | Name of the Transmission Line    | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor              |
|---------|----------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|------------------------|
|         |                                  |                 |                 |                       |           | Suspension           | Tension | Total |                        |
| 12.1    | 400 kV Dadri-Harsh Vihar Ckt-1&2 | NTPC            | 05.06.2024      | 2011-2012             | 4         | 1                    | 0       | 1     | 400 kV Twin Moose ACSR |

### 9.1 400 kV Dadri-Harsh Vihar Ckt-1&2

|     |                                                                                                                                                                                                                             |                                                             |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                               | 400 kV Dadri-Harsh Vihar Ckt-1&2                            |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                           | June 5, 2024; 21:17 Hrs.                                    |
| 3.  | Length of line (km):                                                                                                                                                                                                        | 53.284km                                                    |
| 4.  | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                        | D/C                                                         |
| 5.  | Number of Towers and Type of Towers failed: [Suspension/tension/dead end/special tower/river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 01 No. of Tower failed.<br>Tower Type DA with +6M Extension |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                     | No. 150, Approx.3 km from Harsh Vihar Substation            |
| 7.  | Name and size of conductor:                                                                                                                                                                                                 | Moose ACSR 32mm Size                                        |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                        | Twin                                                        |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                          | 12mm Size, 02 Nos.                                          |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                     | Polymer, 120kN                                              |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                          | I Configuration                                             |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                  | Single I String                                             |
| 13. | Year of construction / commissioning:                                                                                                                                                                                       | 2011-12                                                     |
| 14. | Executing Agency:                                                                                                                                                                                                           | M/s Powergrid                                               |



|     |                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15. | Weather condition on the date of failure:                                                                                                                              | On the evening of June 5, 2024, adverse weather conditions prevailed, marked by severely Cyclonic weather condition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 16. | Terrain Category:                                                                                                                                                      | Normal Plain Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 17. | Reliability Level:                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                          | Wind Zone-4, Velocity 44-47 m/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                               | Pipe Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                           | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 21. | The agency who designed the line:                                                                                                                                      | M/s Powergrid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 22. | Any Special consideration in design:                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 23. | Details of last maintenance activity along with date:                                                                                                                  | Line Patrolling done during the period from 13.05.2024 – 24.05.2024.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 24. | Power flow in the line prior to failure:                                                                                                                               | 350MW each line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 26. | Condition of foundation after failure:                                                                                                                                 | All four concrete foundations of tower-150 were found intact. Structure was found bent above the foundation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 27. | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | On the evening of June 5, 2024, adverse weather conditions prevailed, marked by heavy storms and rainfall. At approximately 21:17 hrs., amidst this stormy condition, both circuits (Ckt-1&2) of the 400KV transmission lines from Dadri to Harsh Vihar tripped on phase-to-phase fault. Concurrently, the 400KV line Dadri-Muradnagar also tripped. Subsequent inspection during line patrolling identified that Tower no-150 of the Dadri-Harsh Vihar circuit had collapsed. Due to the heavy storm effect, uprooting of trees in vicinity as well as damage of 18 Nos. of 11kV towers was observed. |
| 28. | Probable cause of failure:                                                                                                                                             | The root cause of the Tower collapse was the high-velocity swirling winds near the location. These winds were exacerbated by a valley-like depression formed in the area.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 29. | Details of previous failure of the line / tower :                                                                                                                      | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                      | Line restored through Permanent Tower Structure on existing foundation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 31. | Likely date of restoration:                                                                                                                                            | 03.07.2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 32. | Present Status:                                                                                                                                                        | Charged                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 33. | Details of any Tests carried out after failure(attach test reports):                                                                                                   | Following tests were performed before charging of the lines: -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |



|     |                                                                                                                                               |                                                                                      |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|     |                                                                                                                                               | Tower Footing Resistance<br>IR Test<br>Continuity Test<br>Offline fault locator test |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                 |                                                                                      |
| 35. | Location of failed tower<br>a. Location Coordinates:<br>b. Nearest Airport:<br>c. District and State:                                         | 28°43'56"/ 77°20'39"<br>New Delhi<br>Ghaziabad, U.P.                                 |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Attached (Annexure-1)                                                                |
| 37. | Tower weight:                                                                                                                                 | 14637KG                                                                              |
| 38. | Tower spotting data:                                                                                                                          | Attached (Annexure-2)                                                                |
| 39. | Tower schedule of affected section:                                                                                                           | Attached (Annexure-3)                                                                |
| 40. | Sag tension calculation considered for design of tower:                                                                                       | Attached (Annexure-4)                                                                |
| 41. | Design document of failed towers:                                                                                                             | Standard DA Type Tower, BoM and Drawing attached.                                    |
| 42. | Any other relevant information:                                                                                                               |                                                                                      |

**10. AP TRANSCO**

The following Transmission Lines Towers of AP TRANSCO had failed during January 2024 to December 2024.

| Si. No. | Name of the Transmission Line       | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone    | No. of Towers Failed |         |       | Conductor        |
|---------|-------------------------------------|-----------------|-----------------|-----------------------|--------------|----------------------|---------|-------|------------------|
|         |                                     |                 |                 |                       |              | Suspension           | Tension | Total |                  |
| 5.1     | 220kV VSS - Parawada                | APTRANSCO       | 01.06.2024      | -                     | Not Provided | 1                    | 0       | 1     | -                |
| 5.2     | 220KV Pendurthi - Upper Sileru line | APTRANSCO       | 03.10.2024      | 1968                  | 5            | 1                    | 0       | 1     | 220 kV Deer ACSR |

**10.1 220 kV VSS - Parawada**

|     |                                                                                                                                                                                                                             |                                                              |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                               | 220 kV VSS - Parawada                                        |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                           | 01.06.2024 @ 01.15hr                                         |
| 3.  | Length of line (km):                                                                                                                                                                                                        | NA                                                           |
| 4.  | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                        | NA                                                           |
| 5.  | Number of Towers and Type of Towers failed: [Suspension/tension/dead end/special tower/river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | At Loc.455 the A+0 tower collapsed due to(Heavy Rain & Gale) |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                     | Loc.455 (distance 1.933km from 220kV VSS)                    |
| 7.  | Name and size of conductor:                                                                                                                                                                                                 | ACSR DEER                                                    |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                        | 1                                                            |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                          | NA                                                           |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                     | NA                                                           |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                          | NA                                                           |



|     |                                                                                                                                                                                       |                                                                  |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 12. | No. of insulators per string and<br>No. of strings per phase:                                                                                                                         | NA                                                               |
| 13. | Year of construction /<br>commissioning:                                                                                                                                              | NA                                                               |
| 14. | Executing Agency:                                                                                                                                                                     | NA                                                               |
| 15. | Weather condition on the date of<br>failure:                                                                                                                                          | NA                                                               |
| 16. | Terrain Category:                                                                                                                                                                     | NA                                                               |
| 17. | Reliability Level:                                                                                                                                                                    | NA                                                               |
| 18. | Wind Zone (1/2/3/4/5/6) and<br>velocity of wind:                                                                                                                                      | NA                                                               |
| 19. | Details of earthing of tower (pipe<br>type/ Counter poise):                                                                                                                           | NA                                                               |
| 20. | Line designed as per IS:802<br>(1977/1995/2015 any other<br>code):                                                                                                                    | NA                                                               |
| 21. | The agency who designed the<br>line:                                                                                                                                                  | NA                                                               |
| 22. | Any Special consideration in<br>design:                                                                                                                                               | NA                                                               |
| 23. | Details of last maintenance<br>activity along with date:                                                                                                                              | NA                                                               |
| 24. | Power flow in the line prior to<br>failure:                                                                                                                                           | NA                                                               |
| 25. | Any missing member found<br>before / after failure of towers:                                                                                                                         | NA                                                               |
| 26. | Condition of foundation after<br>failure:                                                                                                                                             | NA                                                               |
| 27. | Brief Description of failure: [Along<br>with photographs (if available),<br>other related information like<br>tower schedule, newspaper<br>clipping for cyclone / wind storm<br>etc.] | NA                                                               |
| 28. | Probable cause of failure:                                                                                                                                                            | NA                                                               |
| 29. | Details of previous failure of the<br>line / tower :                                                                                                                                  | NA                                                               |
| 30. | Whether line will be restored on<br>ERS or Spare tower will be used:                                                                                                                  | NA                                                               |
| 31. | Likely date of restoration:                                                                                                                                                           | NA                                                               |
| 32. | Present Status:                                                                                                                                                                       | Rectification work under progress as<br>per mail data 04.06.2024 |
| 33. | Details of any Tests carried out<br>after failure(attach test reports):                                                                                                               | NA                                                               |



|     |                                                                                                                                               |    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|----|
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                 | NA |
| 35. | Location of failed tower<br>a. Location Coordinates:<br>b. Nearest Airport:<br>c. District and State:                                         | NA |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | NA |
| 37. | Tower weight:                                                                                                                                 | NA |
| 38. | Tower spotting data:                                                                                                                          | NA |
| 39. | Tower schedule of affected section:                                                                                                           | NA |
| 40. | Sag tension calculation considered for design of tower:                                                                                       | NA |
| 41. | Design document of failed towers:                                                                                                             | NA |
| 42. | Any other relevant information:                                                                                                               | NA |

**12.2 220 kV Pendurthi -Upper Sileru line**

|     |                                                                                                                                                                                                                               |                                                        |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                 | 220 kV Pendurthi -Upper Sileru line                    |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                             | 03.10.2024 (@17:09Hrs/19:00Hrs                         |
| 3.  | Length of line (km):                                                                                                                                                                                                          | 169 Km                                                 |
| 4.  | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)                                                                                                                                           | S/C tower Horizontal configuration                     |
| 5.  | Number of Towers and Type of Towers failed: [Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | I (Suspension)                                         |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                       | 388                                                    |
| 7.  | Name and size of conductor:                                                                                                                                                                                                   | ACSR DEER                                              |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                          | 1                                                      |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                            | 48F OPGW & 7/3.68mm HTGS wire                          |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                       | Porcelain                                              |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                            | 1                                                      |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                    | 13 Nos Insulators per string and I No string per phase |
| 13. | Year of construction / commissioning:                                                                                                                                                                                         | 1968                                                   |
| 14. | Executing Agency:                                                                                                                                                                                                             |                                                        |
| 15. | Weather condition on the date of failure:                                                                                                                                                                                     | Heavy gale with thunderstorm.                          |
| 16. | Terrain Category:                                                                                                                                                                                                             | Plain                                                  |
| 17. | Reliability Level:                                                                                                                                                                                                            | Not Applicable                                         |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                                                                                 | 5                                                      |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                                                                                      | Pipe                                                   |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                                                                                  | IS:802 (1995)                                          |
| 21. | The agency who designed the line:                                                                                                                                                                                             | K.E.C                                                  |
| 22. | Any Special consideration in design:                                                                                                                                                                                          | Not Applicable                                         |



|     |                                                                                                                                                                        |                                                                                                                             |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 23. | Details of last maintenance activity along with date:                                                                                                                  | PMI carried out on 03.02.2024                                                                                               |
| 24. | Power flow in the line prior to failure:                                                                                                                               | 75MW                                                                                                                        |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | NO                                                                                                                          |
| 26. | Condition of foundation after failure:                                                                                                                                 | Good                                                                                                                        |
| 27. | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Tower stubs rusted inside copings of tower due to water seepage. Heavy gale and thunderstorm present at the time of failure |
| 28. | Probable cause of failure:                                                                                                                                             | Due to heavy gale and rusting of stubs due to water seepage                                                                 |
| 29. | Details of previous failure of the line / tower :                                                                                                                      | -                                                                                                                           |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                      | Same tower was used after stub rectification.                                                                               |
| 31. | Likely date of restoration:                                                                                                                                            | 09.10.2024                                                                                                                  |
| 32. | Present Status:                                                                                                                                                        | Normalcy restored on 09.10.2024                                                                                             |
| 33. | Details of any Tests carried out after failure(attach test reports):                                                                                                   | NIL                                                                                                                         |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                                          |                                                                                                                             |
| 35. | Location of failed tower<br>a. Location Coordinates:<br>b. Nearest Airport:<br>c. District and State:                                                                  | A. Latitude: 17.62783N Longitude: 82.969444E<br>B. Visakhapatnam Airport<br>C. Visakhapatnam, Andhra Pradesh                |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower)                          | Attached                                                                                                                    |
| 37. | Tower weight:                                                                                                                                                          | 3.062MT                                                                                                                     |
| 38. | Tower spotting data:                                                                                                                                                   | Not Available                                                                                                               |
| 39. | Tower schedule of affected section:                                                                                                                                    | Attached                                                                                                                    |
| 40. | Sag tension calculation considered for design of tower:                                                                                                                | Not Available                                                                                                               |
| 41. | Design document of failed towers:                                                                                                                                      | Not Available                                                                                                               |
| 42. | Any other relevant information:                                                                                                                                        | NIL                                                                                                                         |

**11. MSETCL**

The following Transmission Lines Towers of MSERCL had failed during January, 2024 to December, 2024.

| Sl. No. | Name of the Transmissi on Line                                              | Name of Utility | Date of Failure | Year of Commissioni ng | Wind Zone | No. of Towers Failed |         |       | Conduct or             |
|---------|-----------------------------------------------------------------------------|-----------------|-----------------|------------------------|-----------|----------------------|---------|-------|------------------------|
|         |                                                                             |                 |                 |                        |           | Suspensi on          | Tension | Total |                        |
| 11.1    | 220 kV Khaperkhe da- Butibori I Ckt & 220 kV Khaperkhe da- Butibori III Ckt | MSETCL          | 22.04.20 24     | 28.10.1988             | 2         | 1                    | 0       | 1     | 220 kV Zebra ACSR      |
| 11.2    | 400 kV CHD-II- Warora D/C Line                                              | MSETCL          | 22.04.20 24     | 16.01.2014             | 3         | 2                    | 0       | 2     | 400 kV Quad Moose AAAC |
| 11.3    | 220 kV Lamboti - Pandharpur Line & 220 kV Lamboti - Karkamb Line            | MSETCL          | 26.05.20 24     | 1980                   | 1         | 6                    | 0       | 6     | 220 kV Zebra ACSR      |
| 11.4    | 220kV Girwali- Parli Ckt-2 & 220kV Parli-PGCIL Ckt-2 DC line                | MSETCL          | 26.05.20 24     | 25.09.1977             | 2         | 6                    | 0       | 6     | 220 kV Zebra ACSR      |

**11.1 220 kV Khaperkheda- Butibori I Ckt & 220 kV Khaperkheda- Butibori III Ckt**

|   |                                                  |                                                                           |
|---|--------------------------------------------------|---------------------------------------------------------------------------|
| 1 | Name of Transmission line with voltage level:    | 220 kV Khaperkheda- Butibori I Ckt & 220 kV Khaperkheda- Butibori III Ckt |
| 2 | Date and time of occurrence/discovery of failure | On dt. 22.04.2024 at 13:24 Hrs                                            |
| 3 | Length of line (km):                             | 220 kV Khaperkheda- Butibori I Ckt :-57.21 Km & 220 kV                    |



|    |                                                                                                                                                                                                                              |                                                                                                     |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|    |                                                                                                                                                                                                                              | Khaperkheda- Butibori III Ckt:-<br>57.04 Km                                                         |
| 4  | Type of configuration:<br>[(S/C, D/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                           | D/C                                                                                                 |
| 5  | Number of Towers and Type of Towers failed:<br>[suspension/ tension/dead end/special tower/river crossing tower/ Powerline crossing/Railway Crossingetc., with / without extension (indicatethe type & length of extension)] | Suspension Tower :- 1 No                                                                            |
| 6  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                      | Tower location no. :- 127                                                                           |
| 7  | Name and size of conductor:                                                                                                                                                                                                  | 0.4 ACSR Zebra                                                                                      |
| 8  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                         | 0                                                                                                   |
| 9  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                           | 1 No.                                                                                               |
| 10 | Type f insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                       | Porcelain                                                                                           |
| 11 | Configuration of insulators (I / V / Y / tension)                                                                                                                                                                            | 1                                                                                                   |
| 12 | No. of insulators per string and No. of strings per phase:                                                                                                                                                                   | No. of Insulaor per string - 14 nos., No. of string per phase 1 No                                  |
| 13 | Year of construction / commissioning:                                                                                                                                                                                        | 220 kV Khaperkheda- Butibori I Ckt -28.10.1988<br>220 kV Khaperkheda- Butibori III Ckt - 28.10.1988 |
| 14 | Executing Agency:                                                                                                                                                                                                            | M/s. Shreem Infratech                                                                               |
| 15 | Weather condition on the date of failure:                                                                                                                                                                                    | Heavy wind pressure during cyclone                                                                  |
| 16 | Terrain Category:                                                                                                                                                                                                            | Hilly / Plane                                                                                       |
| 17 | Reliability Level                                                                                                                                                                                                            |                                                                                                     |
| 18 | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                                                                                | 2                                                                                                   |
| 19 | Details of earthing of tower (pipe type/Counter poise):                                                                                                                                                                      | Counter poise                                                                                       |



|    |                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20 | Line designed as per IS:802 (1977/1995/any other code):                                                                                                             | NA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 21 | The agency who designed the line:                                                                                                                                   | Departmental                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 22 | Any Special consideration in design:                                                                                                                                | Normal tower (AM+6)                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 23 | Details of last maintenance activity along with date                                                                                                                | Line patrolling done 01.04.2024                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 24 | Power flow in the line prior to failure:                                                                                                                            | 1 ) 220 kV Khaperkheda-Butibori I Ckt :-LBT 197A/75.5 mw &<br>2 )220 kV Khaperkheda-Butibori III Ckt:-LBT 197A/73.65mw                                                                                                                                                                                                                                                                                                                                                                       |
| 25 | Any missing member found before / after failure of towers:                                                                                                          | Nil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 26 | Condition of foundation after failure:                                                                                                                              | Foundation OK (All stubs bent.)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 27 | Brief Description of failure: alongwith photographs(if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | On dt. 22.04.2024 at 13:24 Hrs 220 kV Khaperkheda- Butibori I Ckt & 220 kV Khaperkheda- Butibori III Ckt feeder tripped during heavy cyclone in the area. Post tripping patrolling revealed collapsing of tower loc no. 127 (Normal suspension tower) due to heavy wind pressure during cyclone. The tower is situated on plane area nearby terrain. Tower replacement work has been started from dt. 22.04.2024. Collapsed tower loc no. 127 was commissioned in 28.10.1988 (36 years old). |
| 28 | Probable cause of failure:                                                                                                                                          | Heavy wind pressure during cyclone                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 29 | Details of previous failure of the line / tower :                                                                                                                   | NIL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 30 | Whetherline will be restored on ERS or Spare tower will be used:                                                                                                    | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 31 | Likely date of restoration:                                                                                                                                         | 28.04.2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |



|    |                                                                                                                                             |                            |
|----|---------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 32 | Present Status:                                                                                                                             | Commissioned on 28.04.2024 |
| 33 | Details of any Tests carriedout after failure:                                                                                              | No                         |
| 34 | Wind speed data of date & time of failure from nearby authorised observatory:                                                               | Attached                   |
| 35 | Location of failed tower                                                                                                                    | Loc. No. 127 at Metaumari  |
|    | a) Location Coordinates                                                                                                                     | 21.0870000,78.9020000      |
|    | b)Nearesh Airport:                                                                                                                          | Nagpur                     |
|    | C) District and State:                                                                                                                      | Nagpur Maharashtra         |
| 36 | Single Line diagram/clearance diagram of failed tower(s) with all dimensions(Horizontal & vertical dimensions including base width of tower | Attached                   |
| 37 | Tower weight:                                                                                                                               | 5284 KG                    |
| 38 | Tower spotting data:                                                                                                                        | Attached                   |
| 39 | Tower scheduled of affected section                                                                                                         | Attached                   |
| 40 | Sag tension calculation considered for design of tower                                                                                      | Attached                   |
| 41 | Design document of failed towers:                                                                                                           | Attached                   |
| 42 | Any other relevant information                                                                                                              | NA                         |

**11.2 400 kV CHD-II-Warora D/C Line**

|   |                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                  |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Name of Transmission line with voltage level:                                                                                                                                                                            | 400 kV CHD-II-Warora D/C Line                                                                                                                                                                                                                                                    |
| 2 | Date and time of occurrence/discovery of failure                                                                                                                                                                         | 22.04.2024 At 17:27 Hrs                                                                                                                                                                                                                                                          |
| 3 | Length of line (km):                                                                                                                                                                                                     | 45.73 KM                                                                                                                                                                                                                                                                         |
| 4 | Type of configuration:                                                                                                                                                                                                   | D/C                                                                                                                                                                                                                                                                              |
|   | [(S/C, D/C, S/C sirving on D/C towers, narrow base etc.)                                                                                                                                                                 |                                                                                                                                                                                                                                                                                  |
| 5 | Number of Towers and Type of Towers failed: (suspension/ 4 tension/dead end/special tower/river crossing lower/ Powerline crossing/Railway Crossingete, with/without extension (indicatethe type & length of extension)] | 2 Nos of Special(Suspension) Tower collapsed<br>Loc no 31- DA+50(collapsed Tower- Special Tower- Due to Ash Bund area of CSTPS-Generating station).<br>Loc No 32-DA+50 ( collapsed Tower- Special Tower-Due to Ash bund Area of CSTPS-Generating station)                        |
| 6 | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                  | 30. DD+6 . Tension (Middle conductor Cross Arm Bend),<br>Loc no 31- DA+50(collapsed lower- Special Tower- Due to Ash Bund area of CSTPS).<br>Loc No 32-DA+50 ( collispod Tower- Special Tower-Due to Ash bund Area of CSTPS)<br>(Nearest substation-400 Chandrapur-2 substation) |
| 7 | Name and size of conductor:                                                                                                                                                                                              | 640 -Sq.mm AAAC Moose UpConductor                                                                                                                                                                                                                                                |
| 8 | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                     | Quad Bundle spacing 457 mm                                                                                                                                                                                                                                                       |
| 9 | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                       | 7/3.66 mm GI Earthwire                                                                                                                                                                                                                                                           |



|    |                                                           |                                                                                                   |
|----|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------|
|    |                                                           |                                                                                                   |
| 10 | Type of insulators in use(Porcelain/Glass/Polymer)        | Porcelain                                                                                         |
| 11 | Configuration of insulators (1/V/Y/tension)               | I                                                                                                 |
| 12 | No. of insulators per string and No. of strings per phase | 22 insulators per string & 2 String per phase                                                     |
| 13 | Year of construction/commissioning:                       | 29.05.2013 -warora ckt-1, 16.01.2014 Warora ckt-2                                                 |
| 14 | Executing Agency:                                         | M/s KCL Kobra                                                                                     |
| 15 | Weather condition on the date of failure:                 | Heavy Thunderstorm & Rain accompanied localized cyclone                                           |
| 16 | Terrain Category:                                         | Plain                                                                                             |
| 17 | Reliability Level                                         |                                                                                                   |
| 18 | Wind Zone (1/2/3/4/5/6) and velocity of wind              | Wind zone-3, Velocity of Wind -44 m/s                                                             |
| 19 | Details of earthing of tower (pipe type/Counter poise);   | Pipe Type                                                                                         |
| 20 | Line designed as per IS:802 (1977/1995/any other code):   | NA                                                                                                |
| 21 | The agency who designed the line:                         | M/s KCL Kobra                                                                                     |
| 22 | Any Special consideration in design                       | NA                                                                                                |
| 23 | Details of last maintenance activity along with date      | Tightening corona Ring Nut Bolt-Bph at Loc, No. 31 of 400KV Chand2-Warora ckt-1 on dt. 04.10.2023 |
| 24 | Power flow in the line prior to failure:                  | 154 MW of warora ckt-1 & 161 of Warora ckt-2                                                      |
| 25 | Any missing member found before/after failure of towers   | NO                                                                                                |
| 26 | Condition of foundation after failure:                    | OK                                                                                                |



|    |                                                                                                                                                                       |                                                                                 |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
|    |                                                                                                                                                                       |                                                                                 |
| 27 | Brief Description of failure: along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Due to Heavy Thunderstorm & rain accompanied localized cyclone                  |
| 28 | Probable cause of failure:                                                                                                                                            | Due to Heavy wind thunderstorm & rain accompanied accompanied localized cyclone |
| 29 | Details of previous failure of the line/tower:                                                                                                                        | NIL                                                                             |
| 30 | Whether line will be restored on ERS or Spare tower will be used:                                                                                                     | NO                                                                              |
| 31 | Likely date of restoration:                                                                                                                                           | Commissioned on 08.07.2024                                                      |
| 32 | Present Status:                                                                                                                                                       | Erection of Tower is in progress                                                |
| 33 | Details of any Tests carried out after failure:                                                                                                                       | NIL                                                                             |
| 34 | Wind speed data of date & time of failure from nearby authorised observatory:                                                                                         | Yet to received                                                                 |
| 35 | Location of failed tower                                                                                                                                              | Kachrala village, Tal. Badrawati, Chandrapur.                                   |
|    | a) Location Coordinates                                                                                                                                               | Loc. No. 31- 20.071569, 79.231889, Loc. No. 32- 20.071805, 79.225233            |
|    | b) Nearest Airport:                                                                                                                                                   | Nagpur                                                                          |
|    | c) District and State:                                                                                                                                                | District-Chandrapur, State-Maharashtra                                          |
| 36 | Single Line diagram/clearance diagram of failed tower(s) with all dimensions (Horizontal & vertical dimensions including base width of tower)                         |                                                                                 |
| 37 | Tower weight:                                                                                                                                                         | 80.514 MT per tower                                                             |



|    |                                                        |               |
|----|--------------------------------------------------------|---------------|
| 38 | Tower spotting data:                                   | Attached      |
| 39 | Tower scheduled of affected section                    | Attached      |
| 40 | Sag tension calculation considered for design of tower | Not available |
| 41 | Design document of failed towers:                      | Not available |
| 42 | Any other relevant information                         |               |

### 11.3 220 kV Lamboti -Pandharpur Line & 220 kV Lamboti - Karkamb Line

|   |                                               |                                                                 |
|---|-----------------------------------------------|-----------------------------------------------------------------|
| 1 | Name of Transmission line with voltage level: | 220 kV Lamboti -Pandharpur Line & 220 kV Lamboti - Karkamb Line |
|---|-----------------------------------------------|-----------------------------------------------------------------|



|    |                                                                                                                                                                                                                                   |                                                                                  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| 2  | Date and time of occurrence/discovery of failure:                                                                                                                                                                                 | 26.05.2024 @ 17:25 Hrs                                                           |
| 3  | Length of line (km):                                                                                                                                                                                                              | 220 kV Lamboti -Pandharpur Line : 61 km<br>220 kV Lamboti - Karkamb Line : 94 km |
| 4  | Type of configuration: (S/C, D/C, M/C, S/C strung on D/C towers, narrow base and the like):                                                                                                                                       | DC                                                                               |
| 5  | Number of Towers and Type of Towers failed:<br>[Suspension/ tension/ dead end/ special tower/ river crossing tower/ Power line crossing/ Railway Crossing etc.,with/ without extension (indicate the type & length of extension)] | 6 Nos.& Suspension Type,<br>Extension Type: A, Zero Degree                       |
| 6  | Tower location no. with reference to nearest substation (indicate Name):                                                                                                                                                          | 414 to 419 ( 6 Nos.)<br>(220 kV Pandharpur)                                      |
| 7  | Name and size of conductor:                                                                                                                                                                                                       | ACSR Zebra & 0.4                                                                 |
| 8  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                              | Not Applicable                                                                   |
| 9  | Number and size of earth wire/ OPGW (if provided):                                                                                                                                                                                | 1 Nos (OPGW) 11.7 Sq. mm                                                         |
| 10 | Type of insulators in use (Porcelain/ Glass/ Polymer):                                                                                                                                                                            | Porcelain                                                                        |
| 11 | Configuration of insulators (I/ V/ Y/ tension):                                                                                                                                                                                   | Suspension                                                                       |
| 12 | No. of insulators per string and no. of strings per phase:                                                                                                                                                                        | 14 Insulators/String &<br>1 Strings/Phase                                        |
| 13 | Year of construction/ commissioning:                                                                                                                                                                                              | 220 kV Lamboti -Pandharpur Line: 1980<br>220 kV Lamboti - Karkamb Line: 1980     |
| 14 | Executing agency:                                                                                                                                                                                                                 | Departmental                                                                     |
| 15 | Weather condition on the date of failure:                                                                                                                                                                                         | Cyclone with heavy rain & Wind Storm                                             |
| 16 | Terrain category:                                                                                                                                                                                                                 | Farming Land (BC Soil)                                                           |
| 17 | Reliability level:                                                                                                                                                                                                                | High                                                                             |
| 18 | Wind zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                                                                                     | Wind Zone -1, Velocity of wind Approx.<br>28 m/sec                               |



|    |                                                                                                                                                                        |                                                                                                                                      |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 19 | Details of earthing of tower (pipe type/ counter poise):                                                                                                               | Pipe type                                                                                                                            |
| 20 | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                           | 1977                                                                                                                                 |
| 21 | The agency who designed the line:                                                                                                                                      | Departmental                                                                                                                         |
| 22 | Any special consideration in design:                                                                                                                                   | Not Applicable                                                                                                                       |
| 23 | Details of last maintenance activity along with date:                                                                                                                  | 04.05.2024                                                                                                                           |
| 24 | Power flow in the line prior to failure:                                                                                                                               | 107 MW at 220 kV Pandharpur S/Sn, 97 MW at 220 kV Karkamb S/Sn                                                                       |
| 25 | Any missing member found before/ after failure of towers:                                                                                                              | NO                                                                                                                                   |
| 26 | Condition of foundation after failure:                                                                                                                                 | Broken                                                                                                                               |
| 27 | Brief description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Due to Cyclone with wind storm and Heavy rain Towers at Loc No 414 to 419 collapsed resulting                                        |
| 28 | Probable cause of failure:                                                                                                                                             | Cyclone with wind storm and Heavy rain                                                                                               |
| 29 | Details of previous failure of the line/ tower:                                                                                                                        | Not Applicable                                                                                                                       |
| 30 | Whether line will be restored on ERS or spare tower will be used:                                                                                                      | Spare tower will be used                                                                                                             |
| 31 | Likely date of restoration:                                                                                                                                            | Commisioned on 06.06.2024                                                                                                            |
| 32 | Present status:                                                                                                                                                        | Collapsed towers are dismantled and sapre towers are erected in place. Stringing also done. Both the lines are charged and stood OK. |
| 33 | Details of any tests carried out after failure (attach test reports):                                                                                                  | In Process                                                                                                                           |
| 34 | Wind speed data of date & time of failure from nearby authorised observatory:                                                                                          | Data not recieved from authorised observatory yet.                                                                                   |



|    |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                             |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 35 | Location of failed tower:<br>a. Location Coordinates:<br>b. Nearest Airport:<br>c. District and State:                                          | a. Location Coordinates:<br>Loc. No. 414: 17.6222015, 75.3823263<br>Loc. No. 415: 17.37210, 75.23080<br>Loc. No. 416: 17.622832, 75.388753<br>Loc. No. 417: 17.623098, 75.392112<br>Loc. No. 418: 17.623407, 75.394835<br>Loc. No. 419: 17.623701, 75.398143<br>b. Nearest Airport: Solapur<br>c. District and State: Solapur & Maharashtra |
| 36 | Single line diagram/ clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower): | Not available                                                                                                                                                                                                                                                                                                                               |
| 37 | Tower weight:                                                                                                                                   | 3.98 MT                                                                                                                                                                                                                                                                                                                                     |
| 38 | Tower spotting data:                                                                                                                            | Attached herewith in mail                                                                                                                                                                                                                                                                                                                   |
| 39 | Tower schedule of affected section:                                                                                                             | Existing Corridor is utilised                                                                                                                                                                                                                                                                                                               |
| 40 | Sag-tension calculation considered for design of tower:                                                                                         | Not Available, Information is asked to EHV Project Division                                                                                                                                                                                                                                                                                 |
| 41 | Design document of failed towers:                                                                                                               | Not Available, Information is asked to EHV Project Division                                                                                                                                                                                                                                                                                 |
| 42 | Any other relevant information:                                                                                                                 | Nil                                                                                                                                                                                                                                                                                                                                         |

#### 11.4 220 kV Girwali-Parli Ckt-2 & 220kV Parli-PGCIL Ckt-2 DC line



|     |                                                                                                                                                                                                                               |                                                                         |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                 | 220 kV Girwali-Parli Ckt-2 & 220 kV Parli-PGCIL Ckt-2 DC line           |
| 2.  | Date and time of occurrence/discovery of failure:                                                                                                                                                                             | 26.05.2024 at 15:38 Hrs                                                 |
| 3.  | Length of line (km):                                                                                                                                                                                                          | 18 KM                                                                   |
| 4.  | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                          | D/C                                                                     |
| 5.  | Number of Towers and Type of Towers failed: [Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 6 Nos. of towers and all are A type without extension suspension towers |
| 6.  | Tower location No. with reference to nearest substation (indicate Name):                                                                                                                                                      | 36, 37, 38, 39, 40 & 41 (220Girwali S/s)                                |
| 7.  | Name and size of conductor:                                                                                                                                                                                                   | 0.4 ACSR Zebra                                                          |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                          | NA                                                                      |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                            | 7/3.15 mm Earth wire                                                    |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                       | Porcelain                                                               |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                            | I                                                                       |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                    | 14 insulators per string & 1 string per phase                           |
| 13. | Year of construction / commissioning:                                                                                                                                                                                         | 25.09.1977                                                              |
| 14. | Executing Agency:                                                                                                                                                                                                             | MSETCL Departmental work                                                |
| 15. | Weather condition on the date of failure:                                                                                                                                                                                     | Stormy/Heavy Wind & Heavy Rain                                          |
| 16. | Terrain Category:                                                                                                                                                                                                             | Hilly area                                                              |
| 17. | Reliability Level:                                                                                                                                                                                                            | NA                                                                      |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                                                                                 | Zone-2 and 12 km/hr                                                     |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                                                                                      | Counter poise                                                           |



|     |                                                                                                                                                                        |                                                                                                                  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                           | 1977                                                                                                             |
| 21. | The agency who designed the line:                                                                                                                                      | NA                                                                                                               |
| 22. | Any Special consideration in design:                                                                                                                                   | NA                                                                                                               |
| 23. | Details of last maintenance activity along with date:                                                                                                                  | Monkey Patrolling carried out in m/o April-24.                                                                   |
| 24. | Power flow in the line prior to failure:                                                                                                                               | 20 MW                                                                                                            |
| 25. | Any missing member found before / after failure of towers:                                                                                                             | No missing member found before & after                                                                           |
| 26. | Condition of foundation after failure:                                                                                                                                 | Chimney broken & stubs twisted for all towers                                                                    |
| 27. | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Heavy Wind/stormy weather & heavy rain.& photographs are attached herewith                                       |
| 28. | Probable cause of failure:                                                                                                                                             | Heavy Wind/stormy weather & heavy rain                                                                           |
| 29. | Details of previous failure of the line / tower :                                                                                                                      | Line tripped on distance protection on dtd. 17/04/2024 at 19:00 Hrs, Earth wire snapped between loc. No. 47 & 48 |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                      | Spare tower Material will be used for restoration                                                                |
| 31. | Likely date of restoration:                                                                                                                                            | 220kV Girwali-Parli Ckt-2 & 220kV Parli-PGCIL Ckt-2 DC line commissioned on 4.06.2024 & 06.06.2024 respectively  |
| 32. | Present Status:                                                                                                                                                        | Foundation- 6 nos. completed; Erection- 6 nos. completed, Stringing in progress                                  |
| 33. | Details of any Tests carried out after failure(attach test reports):                                                                                                   | Nut bolt & tower leg sample submitted to ERDA report is awaited                                                  |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                                          | Wind speed on date of Failure = 79 km/hr<br>Report is attached herewith.<br>Link                                 |



|     |                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 35. | <p>Location of failed tower</p> <p>a. Location Coordinates:</p> <p>b. Nearest Airport:</p> <p>c. District and State:</p>                      | <p>a. Location Coordinates:</p> <p>Tower Location No. 36<br/>Latitude-18.7874136 &amp; Longitude-76.5014146.</p> <p>Tower Location No. 37<br/>Latitude-18.7849793&amp; Longitude-76.4987762.</p> <p>Tower Location No. 38<br/>Latitude-18.7835605&amp; Longitude-76.4972575.</p> <p>Tower Location No. 39<br/>Latitude-18.7804532&amp; Longitude-76.4938915.</p> <p>Tower Location No. 40<br/>Latitude-18.7786852 &amp; Longitude-76.4919907.</p> <p>Tower Location No. 41<br/>Latitude-18.7756032&amp; Longitude-76.4886717.</p> <p>b. Nearest Airport: Nanded.</p> <p>c. District and State:Beed &amp; Maharashtra</p> |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Not available                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 37. | Tower weight:                                                                                                                                 | 4.2 MT for each tower                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 38. | Tower spotting data:                                                                                                                          | Not available, line is very old ,date of commissioning of line is 25.09.1977                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 39. | Tower schedule of affected section:                                                                                                           | Not available, line is very old ,date of commissioning of line is 25.09.1977                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 40. | Sag tension calculation considered for design of tower:                                                                                       | Not available, line is very old ,date of commissioning of line is 25.09.1977                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 41. | Design document of failed towers:                                                                                                             | Not available, line is very old ,date of commissioning of line is 25.09.1977                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



|     |                                 |                                                                              |
|-----|---------------------------------|------------------------------------------------------------------------------|
| 42. | Any other relevant information: | Not available, line is very old ,date of commissioning of line is 25.09.1977 |
|-----|---------------------------------|------------------------------------------------------------------------------|

## 12 GETCO

The following Transmission Lines Towers of GETCO had failed during January 2024 to December 2024

*Report of the Standing Committee of Experts on Failure of EHV Transmission Line Towers (January, 2024 – December, 2024)*



| Si. No. | Name of the Transmission Line              | Name of Utility | Date of Failure | Year of Commissioning | Wind Zone | No. of Towers Failed |         |       | Conductor         |
|---------|--------------------------------------------|-----------------|-----------------|-----------------------|-----------|----------------------|---------|-------|-------------------|
|         |                                            |                 |                 |                       |           | Suspension           | Tension | Total |                   |
| 12.1    | 220kV Nanikhakhar-Nakhatrana D/C line      | GETCO           | 09.01.2024      | 30.12.1997            | 5         | 1                    | 0       | 1     | 220 kV Zebra ACSR |
| 12.2    | 220 kV Akri Nakhatrana/Akri Bhachunda Line | GETCO           | 01.07.2024      | 18.02.2004            | 5         | 3                    | 0       | 3     | 220 kV Zebra ACSR |
| 12.3    | 220 kV Tappar-Vondh line                   | GETCO           | 06.10.2024      | 28.06.2013            | 5         | 1                    | 0       | 1     | 220 kV Zebra ACSR |

**12.1 220 kV Nanikhakhar-Nakhatrana D/C line**

|     |                                                                                                                                                                                                                              |                                                                           |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 1.  | Name of Transmission line with voltage level:                                                                                                                                                                                | 220kV Nanikhakhar-Nakhatrana D/C line                                     |
| 2.  | Date and time of occurrence/discovery of failure                                                                                                                                                                             | 09.01.2024                                                                |
| 3.  | Length of line (km):                                                                                                                                                                                                         | 59                                                                        |
| 4.  | Type of configuration:[(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                          | D/C                                                                       |
| 5.  | Number of Towers and Type of Towers failed:[Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | Tower Loc no: 119<br>Type of tower: Suspension, DA+0<br>Without extension |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                      | Tower loc no 119(S), 220kV Nanikhakhar SS                                 |
| 7.  | Name and size of conductor:                                                                                                                                                                                                  | ACSR Zebra                                                                |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                         | Single conductor                                                          |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                           | Single OPGW                                                               |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                      | Polymer                                                                   |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                           | I                                                                         |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                   | Single insulator per phase, Single string per phase.                      |
| 13. | Year of construction / commissioning:                                                                                                                                                                                        | 30.12.1997                                                                |
| 14. | Executing Agency:                                                                                                                                                                                                            | M/S Dildar Electricals                                                    |



|     |                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15. | Weather condition on the date of failure:                    | High wind                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 16. | Terrain Category:                                            | Hill                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 17. | Reliability Level:                                           | Design as old IS:802, Not applicable in old tower design (IS)                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 19. | Details of earthing of tower (pipe type/ Counter poise):     | Counter poise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code): | Line designed as per IS:802 (1977)                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 21. | The agency who designed the line:                            | M/S KALPTRU(KPTL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 22. | Any Special consideration in design:                         | No any special design not considered                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 23. | Details of last maintenance activity along with date:        | 25-08-2023: PSD: Flashed SRI Replaced at loc no 184 BPh<br>16-10-2023: Thermography of all attention locations ( 17 Nos) carried out.<br>03-11-2023: PSD: Jumper hot point attended by providing bypass jumper using firewedge at loc no 100(T) B ph (Hot point observed during thermography of line on 16-10-2023) & Jumper tightening carried out.<br>16-12-2023: Tree cutting carried out at loc no 192-193, 187-188, 183-184<br>18-12-2023: Tree cutting carried out at loc no 180-181, 179-178, 177 |
| 24. | Power flow in the line prior to failure:                     | 51 Amp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 25. | Any missing member found before / after failure of towers:   | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 26. | Condition of foundation after failure:                       | Stub damaged as tower structure totally collapsed.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



|     |                                                                                                                                                                       |                                                                                                                                                    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 27. | Brief Description of failure:[Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Due to wind gust on dated 09.01.2024, line tripped, after petrolling it was found that tower no 119 collapsed.                                     |
| 28. | Probable cause of failure:                                                                                                                                            | High wind and aging of foundation                                                                                                                  |
| 29. | Details of previous failure of the line / tower :                                                                                                                     | During Biporjoy cyclone tower loc no 128(S), 127(S), 126(S) collapsed of said line, the same was restored by replacing it.                         |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                     | New tower erection carried out and line charged on 04.04.2024 at 22:17Hrs.                                                                         |
| 31. | Likely date of restoration:                                                                                                                                           | New tower erection carried out and line charged on 04.04.2024 at 22:17Hrs.                                                                         |
| 32. | Present Status:                                                                                                                                                       | Both lines are in service                                                                                                                          |
| 33. | Details of any Tests carried out after failure(attach test reports):                                                                                                  | no                                                                                                                                                 |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                                         | 19KM/hr on dated -09.01.2024 at 14:30hrs                                                                                                           |
| 35. | Location of failed towera.<br>Location Coordinates:b. Nearest Airport:c. District and State:                                                                          | At: Near Asharani Village, Ta: Mandvi<br>a. Location coordinates: (23.0653145, 69.3766189), b.Nearest Airport: Bhuj<br>c. District: Bhuj , Gujarat |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower)                         | Attached herewith                                                                                                                                  |
| 37. | Tower weight:                                                                                                                                                         | 3.5 MT Approx                                                                                                                                      |
| 38. | Tower spotting data:                                                                                                                                                  | 119(S) DA+0<br>Lat: 23.0653145<br>Long: 69.3766189                                                                                                 |



|     |                                                        |                                                                                                  |
|-----|--------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 39. | Tower schedule of affected section                     | Attached herewith                                                                                |
| 40. | Sag tension calculation considered for design of tower | For ASCR zebra conductor, 32 degree full wind, 3950kg 0 degree 2/3 full wind, 4360kg             |
| 41. | Design document of failed towers:                      | DA+0 tower                                                                                       |
| 42. | Any other relevant information                         | On dated 09.01.2024, due to very high wind gust at Asarani village and tower has been collapsed. |

## 12.2 220 kV Akri Nakhtrana/Akri Bhachunda Line

|    |                                               |                                           |
|----|-----------------------------------------------|-------------------------------------------|
| 1. | Name of Transmission line with voltage level: | 220 kV Akri Nakhtrana/Akri Bhachunda Line |
|----|-----------------------------------------------|-------------------------------------------|



|     |                                                                                                                                                                                                                               |                                                              |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| 2.  | Date and time of occurrence/discovery of failure                                                                                                                                                                              | 01-07-2024 18:00                                             |
| 3.  | Length of line (km):                                                                                                                                                                                                          | 99 km                                                        |
| 4.  | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)]                                                                                                                                          | D/C Tower                                                    |
| 5.  | Number of Towers and Type of Towers failed: [Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | 3 Nos. Suspension Normal Tower                               |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                       | 308-309-310/347-348-349                                      |
| 7.  | Name and size of conductor:                                                                                                                                                                                                   | ACSR Zebra                                                   |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                          | Single conductor                                             |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                            | Single OPGW                                                  |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                       | Polymer                                                      |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                            | I                                                            |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                                                                                    | Single insulator per phase, Single string per phase.         |
| 13. | Year of construction / commissioning:                                                                                                                                                                                         | 18.02.2004                                                   |
| 14. | Executing Agency:                                                                                                                                                                                                             | M/S KALPTRU(KPTL)                                            |
| 15. | Weather condition on the date of failure:                                                                                                                                                                                     | Heavy rain with wind                                         |
| 16. | Terrain Category:                                                                                                                                                                                                             | Costal and creek area                                        |
| 17. | Reliability Level:                                                                                                                                                                                                            | Design as old IS:802,Not applicable in old tower design (IS) |



|     |                                                                                                                                                                       |                                                                                                                         |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                         | 5                                                                                                                       |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                              | 30.01.2004                                                                                                              |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                          | Line designed as per IS:802 (1977)                                                                                      |
| 21. | The agency who designed the line:                                                                                                                                     | M/S KALPTRU(KPTL)                                                                                                       |
| 22. | Any Special consideration in design:                                                                                                                                  | No any special design not considered                                                                                    |
| 23. | Details of last maintenance activity along with date:                                                                                                                 | 17-05-2024 Ground petrolling                                                                                            |
| 24. | Power flow in the line prior to failure:                                                                                                                              | 45 Amp                                                                                                                  |
| 25. | Any missing member found before / after failure of towers:                                                                                                            | NO                                                                                                                      |
| 26. | Condition of foundation after failure:                                                                                                                                | Towers twisted and collapsed.                                                                                           |
| 27. | Brief Description of failure:[Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] | Due to wind gust on dated 01.07.2024, line tripped, after petrolling it was found that tower no. 347-348-349 collapsed. |
| 28. | Probable cause of failure:                                                                                                                                            | Heavy rain, heavy wind and cyclone effect.                                                                              |
| 29. | Details of previous failure of the line / tower :                                                                                                                     | NA                                                                                                                      |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                     | NO                                                                                                                      |
| 31. | Likely date of restoration:                                                                                                                                           | 30-Jul-24                                                                                                               |
| 32. | Present Status:                                                                                                                                                       | Dismantall work completed and foundation work in progress.                                                              |
| 33. | Details of any Tests carried out after failure(attach test reports):                                                                                                  | No any test carried out                                                                                                 |



|     |                                                                                                                                               |                                                                                                                    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                 | Approx 135KM/Hrs due to mini cyclone                                                                               |
| 35. | Location of failed towera. Location Coordinates:b. Nearest Airport:c. District and State:                                                     | Near AKRI MOTA TPS, Nanichher Village, Ta- Lakhpat, Dist- Kutchh.                                                  |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Single line daigram & network is Attached herewith                                                                 |
| 37. | Tower weight:                                                                                                                                 | 3.6 MT Appr.                                                                                                       |
| 38. | Tower spotting data:                                                                                                                          | 308(S): 23.783933, 68.678917<br>309(S): 23.783167, 68.67595<br>310(S): 23.782417, 68.670433                        |
| 39. | Tower schedule of affected section                                                                                                            | Attached with here.                                                                                                |
| 40. | Sag tension calculation considered for design of tower                                                                                        | For ASCR zebra conductor,32degree full wind,3950kg 0 degree 2/3 full wind ,4360kg                                  |
| 41. | Design document of failed towers:                                                                                                             | DA+0 tower                                                                                                         |
| 42. | Any other relevant information                                                                                                                | On dated 01.07.2024, due to heavy rain with very high wind gust at Nanichher village and tower has been collapsed. |

### 12.3 220 kV Tappar- Vondh line

|   |                                                                                    |                           |
|---|------------------------------------------------------------------------------------|---------------------------|
| 1 | Name of Transmission line with voltage level:                                      | 220 kV Tappar- Vondh line |
| 2 | Date and time of occurrence/discovery of failure                                   | 10-06-2024/ 18:36         |
| 3 | Length of line (km):                                                               | 30.7                      |
| 4 | Type of configuration:[(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.) | D/C                       |



|    |                                                                                                                                                                                                                              |                                                                 |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| 5  | Number of Towers and Type of Towers failed:[Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., with / without extension (indicate the type & length of extension)] | Tower Loc no: 79<br>Type of tower: Suspension, DA+0             |
| 6  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                                                                      | 220 KV Vondh SS Loc 79                                          |
| 7  | Name and size of conductor:                                                                                                                                                                                                  | Zebra (7 Strands of steel 3.18MM and 54 Strands of Alu. 3.18MM) |
| 8  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                                                                         | NA                                                              |
| 9  | Number and size of Ground wire/OPGW (if provided):                                                                                                                                                                           | One (7 Strands of 3.25MM)                                       |
| 10 | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                                                                      | Silicon Rubber Insulator                                        |
| 11 | Configuration of insulators (I / V / Y / tension):                                                                                                                                                                           | I                                                               |
| 12 | No. of insulators per string and No. of strings per phase:                                                                                                                                                                   | Single insulator per phase, Single string per phase.            |
| 13 | Year of construction / commissioning:                                                                                                                                                                                        | 6/28/2013                                                       |
| 14 | Executing Agency:                                                                                                                                                                                                            | M/s Bhoomi construction                                         |
| 15 | Weather condition on the date of failure:                                                                                                                                                                                    | Heavywind & Rain                                                |
| 16 | Terrain Category:                                                                                                                                                                                                            | Submerged Black Cotton                                          |
| 17 | Reliability Level:                                                                                                                                                                                                           | Design as old IS:802,Not applicable in old tower design (IS)    |
| 18 | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                                                                                | 5                                                               |
| 19 | Details of earthing of tower (pipe type/ Counter poise):                                                                                                                                                                     | PIPE Type                                                       |



|    |                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                           |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20 | Line designed as per IS:802<br>(1977/1995/2015 any other code):                                                                                                                   | 1995                                                                                                                                                                                                                                                                                                                                                                                      |
| 21 | The agency who designed the line:                                                                                                                                                 | M/S Jyoti Eng.                                                                                                                                                                                                                                                                                                                                                                            |
| 22 | Any Special consideration in design:                                                                                                                                              | No any special design not considered                                                                                                                                                                                                                                                                                                                                                      |
| 23 | Details of last maintenance activity<br>along with date:                                                                                                                          | 09-11-2023: PSD: Flashed SRI<br>Replaced at loc no 70(S)<br>22-12-2023: Tree cutting carried<br>out at loc no 10-11<br>27-01-2024: PSD: Line<br>maintenance work and Rope<br>removing work (Loc no 13 to 16)<br>26-03-2024: Tree cutting carried<br>out at loc no 39-40<br>23-04-2024: Jumper checking<br>work at loc no 67-69<br>21-05-2024: Tree cutting carried<br>out at loc no 54-55 |
| 24 | Power flow in the line prior to failure:                                                                                                                                          | Tappar vondh Line 1= 128MW &<br>Tappar vondh Line 2 =132 MW                                                                                                                                                                                                                                                                                                                               |
| 25 | Any missing member found before /<br>after failure of towers:                                                                                                                     | No                                                                                                                                                                                                                                                                                                                                                                                        |
| 26 | Condition of foundation after failure:                                                                                                                                            | Stub damaged as tower<br>structure totally collapsed.                                                                                                                                                                                                                                                                                                                                     |
| 27 | Brief Description of failure:[Along with<br>photographs (if available), other<br>related information like tower<br>schedule, newspaper clipping for<br>cyclone / wind storm etc.] | Due to heavy wind and rain on<br>dated 10-06-2024, line tripped,<br>after patrolling it was found that<br>tower no 79 collapsed.                                                                                                                                                                                                                                                          |
| 28 | Probable cause of failure:                                                                                                                                                        | High wind & Rain                                                                                                                                                                                                                                                                                                                                                                          |
| 29 | Details of previous failure of the line /<br>tower :                                                                                                                              | Nil                                                                                                                                                                                                                                                                                                                                                                                       |
| 30 | Whether line will be restored on ERS<br>or Spare tower will be used:                                                                                                              | New tower erection will be<br>carried out                                                                                                                                                                                                                                                                                                                                                 |
| 31 | Likely date of restoration:                                                                                                                                                       | 6/22/2024                                                                                                                                                                                                                                                                                                                                                                                 |



|    |                                                                                                                                               |                                                                                      |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 32 | Present Status:                                                                                                                               | New tower erection work under progress                                               |
| 33 | Details of any Tests carried out after failure(attach test reports):                                                                          | Not taken any test                                                                   |
| 34 | Wind speed data of date & time of failure from nearby authorized observatory:                                                                 | 20.0 Knots on 10.06.2024 at 18.36                                                    |
| 35 | Location of failed tower a. Location Coordinates: b. Nearest Airport: c. District and State:                                                  | Kandla Airport, Kutch, Gujarat                                                       |
| 36 | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) | Single line diagram & network is Attached herewith                                   |
| 37 | Tower weight:                                                                                                                                 | 3.5 MT Approx                                                                        |
| 38 | Tower spotting data:                                                                                                                          | Attached herewith                                                                    |
| 39 | Tower schedule of affected section                                                                                                            | Attached herewith                                                                    |
| 40 | Sag tension calculation considered for design of tower                                                                                        | For ASCR zebra conductor, 32 degree full wind, 3950kg 0 degree 2/3 full wind, 4360kg |
| 41 | Design document of failed towers:                                                                                                             | DA+0 tower                                                                           |
| 42 | Any other relevant information                                                                                                                | NA                                                                                   |



## Annexure-III: Proforma for Reporting of Failure of EHV Transmission Line Towers

| SN | Details                                                                                                                                                   | Remarks |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 1. | Name of Transmission line with voltage level:                                                                                                             |         |
| 2. | Date and time of occurrence/discovery of failure:                                                                                                         |         |
| 3. | Length of line (km):                                                                                                                                      |         |
| 4. | Type of configuration: [(S/C, D/C, M/C, S/C strung on D/C towers, narrow base etc.)                                                                       |         |
| 5. | Number of Towers and Type of Towers failed: [Suspension/ tension/dead end/special tower /river crossing tower/ Power line crossing/Railway Crossing etc., |         |



|     |                                                                                                                                                                        |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|     | with / without extension (indicate the type & length of extension)]                                                                                                    |  |
| 6.  | Tower location No. with reference to nearest substation(indicate Name):                                                                                                |  |
| 7.  | Name and size of conductor:                                                                                                                                            |  |
| 8.  | No. of sub-conductors per bundle and bundle spacing:                                                                                                                   |  |
| 9.  | Number and size of Ground wire/OPGW (if provided):                                                                                                                     |  |
| 10. | Type of insulators in use(Porcelain / Glass / Polymer):                                                                                                                |  |
| 11. | Configuration of insulators (I / V / Y / tension):                                                                                                                     |  |
| 12. | No. of insulators per string and No. of strings per phase:                                                                                                             |  |
| 13. | Year of construction / commissioning:                                                                                                                                  |  |
| 14. | Executing Agency:                                                                                                                                                      |  |
| 15. | Weather condition on the date of failure:                                                                                                                              |  |
| 16. | Terrain Category:                                                                                                                                                      |  |
| 17. | Reliability Level:                                                                                                                                                     |  |
| 18. | Wind Zone (1/2/3/4/5/6) and velocity of wind:                                                                                                                          |  |
| 19. | Details of earthing of tower (pipe type/ Counter poise):                                                                                                               |  |
| 20. | Line designed as per IS:802 (1977/1995/2015 any other code):                                                                                                           |  |
| 21. | The agency who designed the line:                                                                                                                                      |  |
| 22. | Any Special consideration in design:                                                                                                                                   |  |
| 23. | Details of last maintenance activity along with date:                                                                                                                  |  |
| 24. | Power flow in the line prior to failure:                                                                                                                               |  |
| 25. | Any missing member found before / after failure of towers:                                                                                                             |  |
| 26. | Condition of foundation after failure:                                                                                                                                 |  |
| 27. | Brief Description of failure: [Along with photographs (if available), other related information like tower schedule, newspaper clipping for cyclone / wind storm etc.] |  |
| 28. | Probable cause of failure:                                                                                                                                             |  |
| 29. | Details of previous failure of the line / tower :                                                                                                                      |  |
| 30. | Whether line will be restored on ERS or Spare tower will be used:                                                                                                      |  |
| 31. | Likely date of restoration:                                                                                                                                            |  |



|     |                                                                                                                                               |  |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|--|
| 32. | Present Status:                                                                                                                               |  |
| 33. | Details of any Tests carried out after failure (attach test reports):                                                                         |  |
| 34. | Wind speed data of date & time of failure from nearby authorized observatory:                                                                 |  |
| 35. | Location of failed tower<br>a. Location Coordinates:<br>b. Nearest Airport:<br>c. District and State:                                         |  |
| 36. | Single line diagram/clearance diagram of failed tower(s) with all dimensions (horizontal & vertical dimensions including base width of tower) |  |
| 37. | Tower weight:                                                                                                                                 |  |
| 38. | Tower spotting data:                                                                                                                          |  |
| 39. | Tower schedule of affected section:                                                                                                           |  |
| 40. | Sag tension calculation considered for design of tower:                                                                                       |  |
| 41. | Design document of failed towers:                                                                                                             |  |
| 42. | Any other relevant information:                                                                                                               |  |

|                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Director General,<br/>Central Power Research Institute,<br/>P B No.8066, Sadashivnagar PO,<br/>Prof. Sir C V Raman Road, Bangalore - 560 080<br/><a href="mailto:dgcpr@cpri.in">dgcpr@cpri.in</a>, <a href="mailto:mchandra@cpri.in">mchandra@cpri.in</a></p>                                       | <p>Member-Secretary,<br/>Southern Regional Power Committee<br/>No. 29, Race Course Cross Road,<br/>Bengaluru- 560009<br/><a href="mailto:mssrpc-ka@nic.in">mssrpc-ka@nic.in</a></p>                                                                                                                                                                     |
| <p>Member-Secretary<br/>Western Regional Power Committee<br/>F-3, MIDC Area, Marol, Opposite SEEPZ,<br/>Central Road, Andheri (East), Mumbai-400093<br/><a href="mailto:ms-wrpc@nic.in">ms-wrpc@nic.in</a>,</p>                                                                                        | <p>Member-Secretary<br/>Eastern Regional Power Committee<br/>14, Golf Club Rd, Golf Gardens,<br/>Tollygunge, Kolkata, West Bengal-700033<br/><a href="mailto:mserpc-power@nic.in">mserpc-power@nic.in</a>,</p>                                                                                                                                          |
| <p>Member-Secretary<br/>Northern Regional Power Committee,<br/>18-A, Qutab Institutional Area, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi 110016<br/><a href="mailto:ms-nrpc@nic.in">ms-nrpc@nic.in</a>,</p>                                                                                   | <p>Member Secretary,<br/>North Eastern Regional Power Committee, NERPC Complex, Dong Parmaw, Lapalang, Shillong - 793006 (Meghalaya).<br/><a href="mailto:nerpc@ymail.com">nerpc@ymail.com</a></p>                                                                                                                                                      |
| <p>Director, TCD, CEA,<br/>Sewa Bhawan, R.K. Puram, New Delhi<br/><a href="mailto:tcdcea@nic.in">tcdcea@nic.in</a></p>                                                                                                                                                                                 | <p>Head of the Department, Civil Engg.,<br/>Delhi Technological University,<br/>Shahbad Daulatpur, Bawana Road, Delhi-110 042 (Fax No.011-27852188)<br/><a href="mailto:sksinghdce@gmail.com">sksinghdce@gmail.com</a></p>                                                                                                                              |
| <p>Director,<br/>Structural Engineering Research Centre, CSIR Campus, Taramani, Post Box No.8287, Chennai-600 113 (Fax No.044-22641734)<br/><a href="mailto:director@serc.res.in">director@serc.res.in</a></p>                                                                                         | <p>Director General,<br/>India Meteorological Department,<br/>Mausam Bhawan, Lodhi Road, New Delhi-110 003 (Ph.011-24616051)<br/><a href="mailto:directorgeneral.imd@imd.gov.in">directorgeneral.imd@imd.gov.in</a><br/><a href="mailto:dgmmt@gmail.com">dgmmt@gmail.com</a><br/><a href="mailto:m.mohapatra@imd.gov.in">m.mohapatra@imd.gov.in</a></p> |
| <p>Chairman &amp; Managing Director,<br/>Madhya Pradesh Power Transmission Co. Ltd.<br/>Block No.2, Shakti Bhawan, Rampur, Jabalpur (M.P.) - 482008.<br/><a href="mailto:md@mptransco.nic.in">md@mptransco.nic.in</a></p>                                                                              | <p>Chairman,<br/>Karnataka Power Transmission Corporation Limited No. 82, Shakti Bhawan, Race Course Road, Bengaluru - 560001<br/><a href="mailto:md@kptcl.com">md@kptcl.com</a><br/><a href="mailto:mdkptcl@gmail.com">mdkptcl@gmail.com</a></p>                                                                                                       |
| <p>Managing Director,<br/>Maharashtra State Electricity Transmission Company Ltd.,<br/>C-19, E-Block Prakashganga, Bandra-Kurla Complex Bandra(E), Mumbai 400 051.<br/><a href="mailto:dirop@mahatransco.in">dirop@mahatransco.in</a><br/><a href="mailto:md@mahatransco.in">md@mahatransco.in</a></p> | <p>Chief Engineer (Transmission)<br/>Jharkhand Urja Sancharan Nigam Ltd. (JUSNL)<br/>Engineering Buliding,<br/>HEC, Dhurwa, Ranchi - 834004<br/><a href="mailto:mdjusnl@gmail.com">mdjusnl@gmail.com</a></p>                                                                                                                                            |
| <p>Managing Director,<br/>Himachal Pradesh Power Development</p>                                                                                                                                                                                                                                       | <p>Chairman &amp; Managing Director<br/>Transmission Corporation of Andhra</p>                                                                                                                                                                                                                                                                          |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Corporation Ltd.<br>Barowalia House, Khalini Shimla - 171004<br><a href="mailto:md@hppcl.in">md@hppcl.in</a>                                                                                                                                                                                                    | Pradesh Limited<br>VidyutSoudha,Gunadala,EluruRd,<br>Vijayawada, Andhra Pradesh 520004<br><a href="mailto:ce.trans@aptransco.gov.in">ce.trans@aptransco.gov.in</a><br><a href="mailto:surendrababu.karreddula@aptransco.co.on">surendrababu.karreddula@aptransco.co.on</a>                                                                |
| Chairman<br>Gujarat Urja Vikas Nigam Ltd.<br>Sardar Patel Vidyut Bhawan, Race Course,<br>Vadodara- 390 007<br><a href="mailto:md.guvnl@gebmail.com">md.guvnl@gebmail.com</a>                                                                                                                                    | Managing Director<br>Gujarat Energy Transmission Corporation Ltd.<br>Sardar Patel Vidyut Bhawan,<br>Race Course, Vadodara- 390 007<br>Ph.: 0265-2353085<br><a href="mailto:md.getco@gebmail.com">md.getco@gebmail.com</a>                                                                                                                 |
| Chairman & Managing Director<br>Orissa Power Transmission Corporation Ltd.<br>Janpath, Bhubaneswar- 751 022.<br><a href="mailto:cmd@optcl.co.in">cmd@optcl.co.in</a><br><a href="mailto:dir.operation@optcl.co.in">dir.operation@optcl.co.in</a>                                                                | Director (Operations)<br>Rajasthan Rajya Vidyut Prasaran Nigam Ltd.<br>Vidyut Bhawan, Jyoti Nagar<br>Jaipur (Rajasthan)<br>Ph.: 0141-2740814<br><a href="mailto:dir.oper@rvpn.co.in">dir.oper@rvpn.co.in</a><br><a href="mailto:cmd.rvpn@gmail.com">cmd.rvpn@gmail.com</a>                                                                |
| Chairman & Managing Director<br>Uttar Pradesh Power Transmission Corporation Ltd.<br>Shakti Bhawan, 14-A, Ashok Marg,<br>Lucknow- 226001<br><a href="mailto:cmd@upptcl.org">cmd@upptcl.org</a>                                                                                                                  | Managing Director<br>Assam Electricity Grid Corporation Ltd.<br>Bijulee Bhawan,<br>Paltan Bazar Guwahati- 781 001<br><a href="mailto:managing.director@aegcl.co.in">managing.director@aegcl.co.in</a> ,<br><a href="mailto:md_aegcl@yahoo.co.in">md_aegcl@yahoo.co.in</a><br><a href="mailto:cgm.ppd@aegcl.co.in">cgm.ppd@aegcl.co.in</a> |
| Chairman & Managing Director,<br>Delhi Transco. Ltd.<br>Shakti Sadan, Kotla Marg,<br>New Delhi – 110002<br><a href="mailto:md@dtl.gov.in">md@dtl.gov.in</a><br><a href="mailto:gmom1.dtl@gmail.com">gmom1.dtl@gmail.com</a><br><a href="mailto:dgmtooperation1.dtl@gmail.com">dgmtooperation1.dtl@gmail.com</a> | Managing Director<br>TANTRANSCO<br>10th Floor/NPKRR Malikai, No. 144 Anna<br>Salai, Chennai-600002<br>Ph.: 044-28521057<br><a href="mailto:mdtantransco@tnebnet.org">mdtantransco@tnebnet.org</a>                                                                                                                                         |
| West Bengal State Electricity Transmission Company Ltd (WBSETCL)<br>Vidyut Bhawan, Block-DJ, Sector-II,<br>Bidhan Nagar, Kolkata- 700 091.<br><a href="mailto:md@wbsetcl.in">md@wbsetcl.in</a>                                                                                                                  | Chairman & Managing Director<br>Chhattisgarh State Power Holding Company Ltd.,<br>Vidyut Seva Bhawan<br>P.O. Sunder Nagar, Danganiya,<br>Raipur- 492 013 (Chhattisgarh)<br><a href="mailto:mddiscom@gmail.com">mddiscom@gmail.com</a> ,<br><a href="mailto:mddiscom@cspc.co.in">mddiscom@cspc.co.in</a>                                   |
| Chairman<br>Haryana Vidyut Prasaran Nigam Ltd.                                                                                                                                                                                                                                                                  | Chairman<br>Kerala State Electricity Board                                                                                                                                                                                                                                                                                                |

|                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Shakti Bhawan, Sector No. 6<br>Panchkula – 134109, Haryana<br><a href="mailto:chairman@hvpn.org.in">chairman@hvpn.org.in</a>                                                                                                                                                                                                                      | Board Secretariat<br>Vidyuthi Bhavanam Pattom<br>Thiruvananthapuram – 695004<br><a href="mailto:cmdkseb@kseb.in">cmdkseb@kseb.in</a>                                                                                                                                                                                                                                                                                |
| Chairman & Managing Director,<br>Transmission Corporation of Telangana Ltd.<br>Vidyut Soudha, Khairatabad,<br>Hyderabad – 500082<br><a href="mailto:cmd@tstransco.in">cmd@tstransco.in</a>                                                                                                                                                        | Managing Director,<br>Bihar State Power Transmission Company Ltd.<br>Vidyut Bhawan, Bailey Road<br>Patna – 800021<br><a href="mailto:mdcellbsptcl@gmail.com">mdcellbsptcl@gmail.com</a>                                                                                                                                                                                                                             |
| Managing Director,<br>Power Transmission Corporation of<br>Uttarakhand Ltd.<br>Vidyut Bhawan, Saharnpur Road,<br>Near I.S.B.T. Crossing, Dehradun<br>Uttarakhand – 248002<br><a href="mailto:md@ptcul.org">md@ptcul.org</a>                                                                                                                       | Chairman & Managing Director,<br>Punjab State Transmission Corporation Ltd.<br>The Mall, Mall Road,<br>Patiala – 147001, Punjab<br><a href="mailto:cmd@pstcl.org">cmd@pstcl.org</a>                                                                                                                                                                                                                                 |
| Managing Director,<br>Jammu & Kashmir State Power Transmission Corporation Ltd.<br>Exhibition Ground, Jahangir Chowk, Srinagar (J&K) - 190009<br><a href="mailto:md@jkspdcl.com">md@jkspdcl.com</a><br><a href="mailto:mdjkptcl1@gmail.com">mdjkptcl1@gmail.com</a>                                                                               | The Engineer-in-Chief<br>Power and Electricity Deptt., Govt. of Mizoram,<br>Power House, Bara Bazar<br>Aizwal- 796 001, Mizoram<br><br><a href="mailto:eincplanning@gmail.com">eincplanning@gmail.com</a><br><a href="mailto:mizoplan@gmail.com">mizoplan@gmail.com</a>                                                                                                                                             |
| Chairman & Managing Director<br>Meghalaya Energy Corporation Ltd.<br>Lumjingshai Short Round Road<br>Shillong- 793 001.<br><a href="mailto:directormeptcl@gmail.com">directormeptcl@gmail.com</a><br><a href="mailto:cetranzemeptcl@gmail.com">cetranzemeptcl@gmail.com</a><br><a href="mailto:apborkharpan@gmail.com">apborkharpan@gmail.com</a> | Chief Engineer (P)<br>Manipur Electricity Department<br>Govt. of Manipur,<br>Manipur Sectt.<br>South Block, Imphal,<br>Manipur- 795 001.<br><a href="mailto:md.mspcl@gmail.com">md.mspcl@gmail.com</a><br><a href="mailto:ed.tech.mspcl@gmail.com">ed.tech.mspcl@gmail.com</a><br><a href="mailto:sandei@ymail.com">sandei@ymail.com</a>                                                                            |
| Chief Engineer<br>Nagaland Deptt. of Power<br>Kohima 797 001 Nagaland<br><a href="mailto:cetransgen@gmail.com">cetransgen@gmail.com</a><br><a href="mailto:asang.dcare@gmail.com">asang.dcare@gmail.com</a><br><a href="mailto:secyit-ngl@nic.in">secyit-ngl@nic.in</a><br><a href="mailto:vizo123gmail.com">vizo123gmail.com</a>                 | Chief Engineer (Power), Department of Power<br>Govt. of Arunachal Pradesh<br>Itanagar (Arunachal Pradesh) – 791 111<br><a href="mailto:setrans26@gmail.com">setrans26@gmail.com</a><br><a href="mailto:tklara@hotmail.com">tklara@hotmail.com</a><br><a href="mailto:vidyutarunachal@rediffmail.com">vidyutarunachal@rediffmail.com</a><br><a href="mailto:vidyutarunachal@gmail.com">vidyutarunachal@gmail.com</a> |
| Chairman & Managing Director<br>Tripura State Elec. Corporation Ltd.<br>Govt. of Tripura, Bidyut Bhawan<br>Agartala- 799 001.                                                                                                                                                                                                                     | Chairman & Managing Director,<br>Chhattisgarh State Power Transmission Company Limited,<br>Vidyut Seva Bhavan, Danganiya,                                                                                                                                                                                                                                                                                           |

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| <a href="mailto:managing.director@tsecl.in">managing.director@tsecl.in</a><br><a href="mailto:director.technical@tsecl.in">director.technical@tsecl.in</a><br><a href="mailto:cmd.tsecl@rediffmail.com">cmd.tsecl@rediffmail.com</a>                | Raipur (CG) 492013<br><a href="mailto:chairman@cspc.co.in">chairman@cspc.co.in</a> ;<br><a href="mailto:mdtransco@cspc.co.in">mdtransco@cspc.co.in</a> ;                                                                           |
| Chairman & Managing Director<br>Rajasthan Rajya Vidyut Utpadan Nigam Ltd.<br>Vidyut Bhawan, Jyoti Nagar Jaipur (Rajasthan)<br><a href="mailto:cmd@rrvun.com">cmd@rrvun.com</a><br><a href="mailto:dir.oper@rvpn.co.in">dir.oper@rvpn.co.in</a>      | Managing Director<br>Jammu & Kashmir State Power Development Corporation Ltd, PDD Building, Exhibition Grounds, Opposite High Court, Jahangir Chowk, Srinagar (J&K) 190009<br><a href="mailto:md@jkspdccl.com">md@jkspdccl.com</a> |
| Commissioner-cum-Secretary(P)<br>Andaman and Nicobar Electricity Department, Secretariat,<br>Andaman and Nicobar Islands, Port Blair- 744 101<br><a href="mailto:secyship14@gmail.com">secyship14@gmail.com</a>                                     | Secretary<br>Dadra & Nagar Haveli Electricity Department,<br>Dadar Nagar Secretariat, Silvassa- 396230<br><a href="mailto:tapasyaraghav@gmail.com">tapasyaraghav@gmail.com</a>                                                     |
| Secretary<br>Lakshadweep Elec. Department<br>U.T. of Lakshyadeep Kavaratti- 682555<br><a href="mailto:lk-ktelect@nic.in">lk-ktelect@nic.in</a>                                                                                                      | Secretary<br>Puducherry Elec. Department<br>Secretariat, Puducherry- 605001<br><a href="mailto:secycs.pon@nic.in">secycs.pon@nic.in</a><br><a href="mailto:secytran.pon@nic.in">secytran.pon@nic.in</a>                            |
| Managing Director<br>Karnataka Power Corporation Limited<br>No. 82, Shakthi Bhavan, Race Course Road, Bengaluru - 560001<br><a href="mailto:mdkpcl@gmail.com">mdkpcl@gmail.com</a>                                                                  | Chairman<br>Jharkhand Urja Utpadan Nigam Ltd.<br>Engineering Building, HEC Dhurwa, Ranchi-834004<br><a href="mailto:mdjuunl2018@gmail.com">mdjuunl2018@gmail.com</a>                                                               |
| Chairman & Managing Director<br>West Bengal Power Development Corporation Ltd.(WBPDCCL)<br>Bidyut Unnayan Bhawan, plot 3/C, LABlock, Sector-III, Salt Lake City, Kolkata - 700 098<br><a href="mailto:wbpdccl@wbpdcl.co.in">wbpdcl@wbpdcl.co.in</a> | Managing Director Chhattisgarh State Power Generation Company Ltd., Vidyut Seva Bhawan P.O. Sunder Nagar, Danganiya, Raipur- 492 013(Chhattisgarh)<br><a href="mailto:mdgenco@cspc.co.in">mdgenco@cspc.co.in</a>                   |
| Chief Engineer(Elect.)<br>Goa Electricity Department<br>Vidyut Bhawan, Panaji, Goa- 403001<br><a href="mailto:cee-elec.goa@nic.in">cee-elec.goa@nic.in</a><br><a href="mailto:elec.goa@nic.in">elec.goa@nic.in</a>                                  | Chairman & Managing Director<br>U.P. Rajya Vidyut Utpadan Nigam Ltd., Shakti Bhawan, 14- Ashok Marg, Lucknow-226001<br><a href="mailto:cmd@upptcl.org">cmd@upptcl.org</a>                                                          |
| Managing Director,<br>Bihar State Power Generation Company Limited 5th Floor, Vidyut Bhawan, Bailey Road, Patna (Bihar)<br><a href="mailto:md.bspgcl@gmail.com">md.bspgcl@gmail.com</a>                                                             | Chairman & Managing Director<br>Meghalaya Energy Corporation Ltd.<br>Lumjingshai Short Round Road Shillong- 793 001<br><a href="mailto:ewnong@yahoo.com">ewnong@yahoo.com</a>                                                      |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                             | <a href="mailto:directormeptcl@gmail.com">directormeptcl@gmail.com</a><br><a href="mailto:cetranzemeptcl@gmail.com">cetranzemeptcl@gmail.com</a><br><a href="mailto:meecl.webportal@gmail.com">meecl.webportal@gmail.com</a><br><a href="mailto:apborkharpan@gmail.com">apborkharpan@gmail.com</a>                                                                                                                    |
| Managing Director<br>Sikkim Power Development Corporation Ltd.<br>31-A, N.H. Way, Gangtok- 737 101<br><a href="mailto:sikkim.serc@gmail.com">sikkim.serc@gmail.com</a>                                                                                                                                                                                                                                                                      | Chief Engineer<br>Nagaland Deptt. of Power<br>Kohima 797 001 Nagaland<br><a href="mailto:secyit-ngl@nic.in">secyit-ngl@nic.in</a><br><a href="mailto:vizo123@gmail.com">vizo123@gmail.com</a><br><a href="mailto:cetransgen@gmail.com">cetransgen@gmail.com</a>                                                                                                                                                       |
| Chairman & Managing Director<br>Tripura State Elec. Corporation Ltd.<br>Govt. of Tripura, Bidyut Bhawan Agartala- 799 001<br><a href="mailto:cmd.tsecl@rediffmail.com">cmd.tsecl@rediffmail.com</a><br><a href="mailto:managing.director@tsecl.in">managing.director@tsecl.in</a><br><a href="mailto:director.technical@tsecl.in">director.technical@tsecl.in</a><br><a href="mailto:cmd.tsecl@rediffmail.com">cmd.tsecl@rediffmail.com</a> | Chief Engineer (Power)<br>Department of Power<br>Govt. of Arunachal Pradesh Itanagar<br>(Arunachal Pradesh) – 791 111<br><a href="mailto:vidyutarunachal@rediffmail.com">vidyutarunachal@rediffmail.com</a><br><a href="mailto:vidyutarunachal@gmail.com">vidyutarunachal@gmail.com</a><br><a href="mailto:setrans26@gmail.com">setrans26@gmail.com</a><br><a href="mailto:tklara@hotmail.com">tklara@hotmail.com</a> |
| The Engineer-in-Chief<br>Power and Electricity Deptt.,<br>Govt. of Mizoram, Power House, Bara Bazar<br>Aizwal- 796 001, Mizoram<br><a href="mailto:eincpower@gmail.com">eincpower@gmail.com</a><br><a href="mailto:eincplanning@gmail.com">eincplanning@gmail.com</a><br><a href="mailto:mizoplan@gmail.com">mizoplan@gmail.com</a>                                                                                                         | Chief Engineer (P)<br>Manipur Electricity Department Govt. of<br>Manipur,<br>Manipur Sectt. South Block, Imphal,<br>Manipur- 795 001<br><a href="mailto:snandei@gmail.com">snandei@gmail.com</a><br><a href="mailto:md.mspcl@gmail.com">md.mspcl@gmail.com</a><br><a href="mailto:ed.tech.mspcl@gmail.com">ed.tech.mspcl@gmail.com</a>                                                                                |
| Chairman & Managing Director<br>TANGEDCO<br>10th Floor/NPKR Ramasamy Malikai, No. 144,<br>Anna Salai, Chennai – 600 002<br><a href="mailto:chairman@tnebn.net">chairman@tnebn.net</a>                                                                                                                                                                                                                                                       | Chairman & Managing Director,<br>POWERGRID, Saudamini, Plot No.2, Sector<br>29, Near IFFCO Chowk, Gurgaon – 122<br>001<br><a href="mailto:cmd@powergrid.in">cmd@powergrid.in</a>                                                                                                                                                                                                                                      |
| Chairman & Managing Director,<br>NTPC Ltd.<br>NTPC Bhawan, Core 7, Scope Complex 7,<br>Institutional Area Lodhi Road, New Delhi-<br>110003<br><a href="mailto:cmd@ntpc.co.in">cmd@ntpc.co.in</a><br><a href="mailto:amanna@ntpc.co.in">amanna@ntpc.co.in</a><br><a href="mailto:kamalverma@ntpc.co.in">kamalverma@ntpc.co.in</a><br><a href="mailto:shipratyagi@ntpc.co.in">shipratyagi@ntpc.co.in</a>                                      | Chairman & Managing Director<br>THDC INDIA LTD.<br>Pragatipuram, Bye Pass Road, Rishikesh<br>249 201 (Uttarakhand)<br><a href="mailto:cmd@thdc.co.in">cmd@thdc.co.in</a>                                                                                                                                                                                                                                              |
| Chairman<br>Bhakra Beas Management Board,<br>Sector -19B, Madhya Marg,<br>Chandigarh – 160019<br><a href="mailto:cman@bbmb.nic.in">cman@bbmb.nic.in</a>                                                                                                                                                                                                                                                                                     | Chairman & Managing Director<br>SJVN LIMITED<br>Himfed Building, New Shimla 171 009<br><a href="mailto:sectt.cmd@sjvn.nic.in">sectt.cmd@sjvn.nic.in</a><br><a href="mailto:nandlal.sharma@sjvn.nic.in">nandlal.sharma@sjvn.nic.in</a>                                                                                                                                                                                 |

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| Chairman & Managing Director<br>NEEPCO Ltd.<br>Brookland Compund Shillong – 793 003<br><a href="mailto:vkshnhpc@yahoo.co.in">vkshnhpc@yahoo.co.in</a>                                                                                                                                                                                                                                                                                                                                                    | Chairman & Managing Director,<br>Damodar Valley Corporation (DVC)<br>Head Quarter DVC Towers, VIP Road<br>Kolkata – 700054<br><a href="mailto:chairman@dvc.gov.in">chairman@dvc.gov.in</a>                                                                                                                                                                                                                                                                                                                          |
| Chairman & Managing Director<br>NLC India Limited<br>Cuddalore District, Tamilnadu<br><a href="mailto:cmd@nlcindia.in">cmd@nlcindia.in</a>                                                                                                                                                                                                                                                                                                                                                               | Chairman & Managing Director<br>NPCIL<br>Nabhikiya Urja Bhavan, Anushaktinagar,<br>Mumbai-400094<br><a href="mailto:npciltecrectt@npcil.co.in">npciltecrectt@npcil.co.in</a>                                                                                                                                                                                                                                                                                                                                        |
| Chairman & Managing Director<br>National Hydro Power Corporation Ltd.<br>Corporate Office, NHPC Office Complex,<br>Sector 33, Faridabad- 121003, Haryana<br><a href="mailto:cmd@nhpc.nic.in">cmd@nhpc.nic.in</a>                                                                                                                                                                                                                                                                                         | Shri E.V. Rao,<br>KEC International Limited,<br>RPG House, 463, Dr. Annie Besant Road,<br>Worli, Mumbai-4000 03<br><a href="mailto:raoenv@kecrpg.com">raoenv@kecrpg.com</a><br><a href="mailto:kecindia@kecrpg.com">kecindia@kecrpg.com</a>                                                                                                                                                                                                                                                                         |
| Chairman,<br>Resonia Limited ( erstwhile Sterlite Power<br>Transmission Ltd.),<br>The Mira Corporate, Suit, Plot No. 1&2, C<br>Block, 2nd Floor, Ishwar Nagar, Mathura<br>Road, New Delhi – 110065<br><a href="mailto:rohit.gera@sterlite.com">rohit.gera@sterlite.com</a><br><a href="mailto:tan.reddy@sterlite.com">tan.reddy@sterlite.com</a><br><a href="mailto:kamlesh.garg@sterlite.com">kamlesh.garg@sterlite.com</a><br><a href="mailto:arun.sharma1@sterlite.com">arun.sharma1@sterlite.com</a> | Shri Milind Nene<br>Dy. President,<br>Kalpataru Power Transmission Ltd.,<br>Plot No. 101, Part-III,<br>GIDC Estate, Sector-28,<br>Gandhinagar-382028, Gujarat<br><a href="mailto:milind.nene@kalptarupower.com">milind.nene@kalptarupower.com</a><br><a href="mailto:kaushal.thakkar@kalptarupower.com">kaushal.thakkar@kalptarupower.com</a><br><a href="mailto:thakkarkaushal86@yahoo.com">thakkarkaushal86@yahoo.com</a><br><a href="mailto:ajay.tripathi@kalptarupower.com">ajay.tripathi@kalptarupower.com</a> |
| Mr. Bipin B. Shah,<br>Vice President–Transmission,<br>Torrent Power Limited, 3rd Floor, Jubilee 2.<br>House, Shahpur, Ahmedabad-380001<br><a href="mailto:bipinbshah@torrentpower.com">bipinbshah@torrentpower.com</a><br><a href="mailto:kashyapdesai@torrentpower.com">kashyapdesai@torrentpower.com</a><br><a href="mailto:NAMANSHAH@torrentpower.com">NAMANSHAH@torrentpower.com</a><br><a href="mailto:MAYANKGUPTA@torrentpower.com">MAYANKGUPTA@torrentpower.com</a>                               | Shri P.G. Suresh Kumar,<br>Director, L&T IDPL,<br>Kudgi Transmission Ltd., 1 st Floor, TCTC<br>Building, Mount Poonamallee Road,<br>Manapakkam, Chennai-600 089<br><a href="mailto:pgsk@Lntidpl.com">pgsk@Lntidpl.com</a><br><a href="mailto:csr@Intecc.com">csr@Intecc.com</a>                                                                                                                                                                                                                                     |
| Sr. Vice President,<br>M/s Adani Power Limited, 7th Floor,<br>Sambhav Building, Judges Bungalow Road,<br>Bodakdev, Ahmedabad, Gujarat-380015<br><a href="mailto:Anil.sardana@adani.com">Anil.sardana@adani.com</a><br><a href="mailto:praveen.tamak@adani.com">praveen.tamak@adani.com</a><br><a href="mailto:sameer.ganju@adani.com">sameer.ganju@adani.com</a><br><a href="mailto:sunnykumar.singh@adani.com">sunnykumar.singh@adani.com</a>                                                           | Director General,<br>Electric Power Transmission Association,<br>First Floor, 6 Basant Lok, Vasant Vihar,<br>New Delhi - 110070<br><a href="mailto:dg.epta@epta.in">dg.epta@epta.in</a><br><a href="mailto:epta.dg@gmail.com">epta.dg@gmail.com</a>                                                                                                                                                                                                                                                                 |
| Shri Suresh Reddi<br>Director<br>L&T Infrastructure Development Projects<br>Limited (L&T IDPL),<br>L&T campus TCTC building , First Floor,<br>Mount Poonamalle Road, Manapakkam,<br>Chennai-600089, Tamil Nadu, India.                                                                                                                                                                                                                                                                                   | Chairman & Managing Director<br>Neyveli Lignite Corporation Limited<br>Corporate Office, Block -1 Neyveli –<br>607801<br><a href="mailto:cmd@nlcindia.in">cmd@nlcindia.in</a>                                                                                                                                                                                                                                                                                                                                       |

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| <a href="mailto:contactus@Intidpl.com">contactus@Intidpl.com</a><br><a href="mailto:csr@Inteccc.com">csr@Inteccc.com</a>                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p>Chairman &amp; Managing Director<br/>Reliance Power<br/>Reliance Centre, Ground Floor<br/>19, Walchand Hirachand Marg,<br/>Ballard Estate, Mumbai 400 001</p> <p><a href="mailto:reliancepower.investors@relianceada.com">reliancepower.investors@relianceada.com</a><br/> <a href="mailto:rpower.mcafilling@relianceada.com">rpower.mcafilling@relianceada.com</a><br/> <a href="mailto:reliancepower.ipo@relianceada.com">reliancepower.ipo@relianceada.com</a></p>                                                   | <p>Shri Vijayanand Semletty<br/>Associate Director-Commercial &amp;<br/>Regulatory, Sekura<br/>503A, Windsor, Off CST Road, Kalina<br/>Mumbai-400098</p> <p><a href="mailto:Vijayanand.Semletty@Sekura.in">Vijayanand.Semletty@Sekura.in</a><br/> <a href="mailto:Neeraj.Verma@energy-sel.com">Neeraj.Verma@energy-sel.com</a>;<br/> <a href="mailto:Nimish.Sheth@energy-sel.com">Nimish.Sheth@energy-sel.com</a>;</p>  |
| <p>Director,<br/>Darbhanga – Motihari Transmission Co. Ltd.<br/>6th Floor, Plot No. 19 &amp; 20, Film City,<br/>Sector 16 –A, Noida, Uttar Pradesh – 201301</p> <p><a href="mailto:Neeraj.Verma@SEKURA.IN">Neeraj.Verma@SEKURA.IN</a><br/> <a href="mailto:Nimish.Sheth@SEKURA.IN">Nimish.Sheth@SEKURA.IN</a><br/> <a href="mailto:Vijayanand.Semletty@Sekura.in">Vijayanand.Semletty@Sekura.in</a></p>                                                                                                                    | <p>Chairman and Managing Director,<br/>M/s Juniper Green Transmission Private<br/>Limited</p> <p><a href="mailto:rohit.gera@junipergreenenergy.com">rohit.gera@junipergreenenergy.com</a><br/> <a href="mailto:rohit.gera91@gmail.com">rohit.gera91@gmail.com</a></p>                                                                                                                                                   |
| <p>Chairman &amp; Managing Director,<br/>Tata Power,<br/>NDPL House, Hudson Lines, Kingsway Camp<br/>Delhi-110 009</p> <p><a href="mailto:BD@tatapower.com">BD@tatapower.com</a><br/> <a href="mailto:neeraj.srivastava@tatapower.com">neeraj.srivastava@tatapower.com</a><br/> <a href="mailto:piyushkumar@tatapower.com">piyushkumar@tatapower.com</a><br/> <a href="mailto:nitin.kumar@tatapower.com">nitin.kumar@tatapower.com</a><br/> <a href="mailto:vrshrishande@tatapower.com">vrshrishande@tatapower.com</a></p> | <p>Chairman &amp; Managing Director,<br/>M/s ReNew Transmission Ventures<br/>Private Limited</p> <p><a href="mailto:anuj.jain@renewpower.in">anuj.jain@renewpower.in</a><br/> <a href="mailto:mohit.jain@renewpower.in">mohit.jain@renewpower.in</a><br/> <a href="mailto:amit.kumar1@renewpower.in">amit.kumar1@renewpower.in</a></p>                                                                                  |
| <p>Director,<br/>M/s G R Infraproject Limited</p> <p><a href="mailto:transmission@grinfra.com">transmission@grinfra.com</a><br/> <a href="mailto:ashwin@grinfra.com">ashwin@grinfra.com</a><br/> <a href="mailto:modassar.a@grinfra.com">modassar.a@grinfra.com</a><br/> <a href="mailto:akul.s@grinfra.com">akul.s@grinfra.com</a></p>                                                                                                                                                                                    | <p>Chairman &amp; Managing Director,<br/>M/s Apraava Energy Private Limited</p> <p><a href="mailto:Rajiv.mishra@apraava.com">Rajiv.mishra@apraava.com</a><br/> <a href="mailto:naveen.munjhal@apraava.com">naveen.munjhal@apraava.com</a><br/> <a href="mailto:roshni.shah@apraava.com">roshni.shah@apraava.com</a><br/> <a href="mailto:sumit.sinha@apraava.com">sumit.sinha@apraava.com</a></p>                       |
| <p>CMD,<br/>M/s Megha Engineering &amp; Infrastructures<br/>Ltd.,</p> <p><a href="mailto:jsrinivaskumar@meilgroup.in">jsrinivaskumar@meilgroup.in</a></p>                                                                                                                                                                                                                                                                                                                                                                  | <p>Shri I R Venkatraman<br/>(Head &amp; VP - Regulatory &amp; Contracts)<br/>Unit No. 101, First Floor, Windsor, Village<br/>KoleKalyan, off CST Road, Vidyanagari<br/>Marg, Kalina, Santacruz (East), Mumbai –<br/>400 098</p> <p><a href="mailto:venkatraman.inumula@indigrid.com">venkatraman.inumula@indigrid.com</a><br/> <a href="mailto:vivek.karthikeyan1@indigrid.com">vivek.karthikeyan1@indigrid.com</a></p> |
| <p>Shri Gulam Mir Mohd.<br/>Electric M &amp;RE Division,<br/>Choglamsar, Leh-Ladakh194101</p> <p><a href="mailto:cepladakh@gmail.com">cepladakh@gmail.com</a></p>                                                                                                                                                                                                                                                                                                                                                          | <p>Chairman &amp; Managing Director<br/>Pragati Power Corporation Limited<br/>Himadri, Rajghat Power House Complex,<br/>New Delhi – 110002</p> <p><a href="mailto:md.ipgpp@nic.in">md.ipgpp@nic.in</a></p>                                                                                                                                                                                                              |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>Essar Power<br/>Sh. Partha Bhattacharya,<br/>27th KM, Surat Hazira Road, District Surat,<br/>Hazira, Gujarat 394270<br/><a href="mailto:Tamendra.Kumar@essarpower.co.in">Tamendra.Kumar@essarpower.co.in</a>;<br/><a href="mailto:Rajive.Tiwari@essarpower.co.in">Rajive.Tiwari@essarpower.co.in</a>;<br/><a href="mailto:Rajat.Bajpai@essarpower.co.in">Rajat.Bajpai@essarpower.co.in</a>;<br/><a href="mailto:khilendra.pant@essarpower.co.in">khilendra.pant@essarpower.co.in</a></p> |  |
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