CALIFORNIA PUBLIC UTILITIES COMMISSION
Safety and Enforcement Division
Electric Safety and Reliability Branch

Incident Investigation Report

Report Date:

Incident Number: E 20191011-01

Utility: SCE

Date and Time of the Incident: 10/10/2019, 9:00:00 PM

Location of the Incident: Field located behind 14000 Saddle Ridge Road Sylmar, CA

County: Los Angeles

Summary of Incident:

On October 10, 2019, at 8:57 pm, an insulator Y-clevis end fitting installed on SCE tower M5-T2 (Mile 5-Tower 2) failed, causing the 220 kV transmission conductor that it had been supporting to fall onto an underbuilt steel arm. The contact between the 220 kV conductor and the steel arm created a phase to ground fault on SCE tower M5-T2. Consequently, the 220 kV circuit relayed to lockout. At approximately 9:00 pm, three miles upstream from tower M5-T2, burning occurred at the footings of two other SCE towers: M2-T4 and M2-T5. As a result of the burning, a fire ignited at the base of tower M2-T5. On October 31, 2019, LAFD fully contained the fire, which consumed 8,799 acres, damaged 88 structures, destroyed 19 structures, injured 8 personnel and civilians, and resulted in one fatality of a civilian due to a heart attack. My investigation found that SCE did not maintain the Y-clevis end fitting and a skyline jumper wire prior to them failing.

Fatality / Injury: 8 injuries and 1 fatality

Property Damage: More than $50,000

Utility Facilities involved: 220 kV Gold-Sylmar Circuit

Witnesses:

	Name	*Title*	*Phone*
1.	Eric Ujiiye	CPUC Investigator	N/A
2.	Paul Pimentel	SCE Senior Manager	[redacted]
3.	[redacted]	SCE Claims Investigator	[redacted]
4.	[redacted]	OWR Nursery Employee	[redacted]
5.	[redacted]	LAFD Arson Investigator	
6.	[redacted]	Resident Witness	

Evidence:

	Source	*Description*
1.	SCE	Initial Report
2.	SCE	Final Report
3.	SCE	Data Request No. 1
4.	SCE	Data Request No. 2
5.	SCE	Data Request No. 3
6.	SCE	Data Request No. 4
7.	SCE	Data Request No. 5
8.	SCE	Data Request No. 6
9.	CPUC	Photographs
10.	LAFD	Photograph

Observations and Findings:

In 1970, SCE installed towers M5-T2, M2-T5, and M2-T4. "M" stands for mile and "T" stands for tower. For example, M5-T2 represents Mile 5, Tower 2. Figure 1 shows the location of the towers in Sylmar. Figure 2 shows the general configuration of each tower. In Figure 2, the left side of the tower supports the 220 kV Eaglerock-Sylmar circuit, with the pair of conductors on the top arm, the pair of conductors on the middle arm, and the pair of conductors on the bottom arm corresponding to the B, C, and A phases, respectively. Also in Figure 2, the right side of the tower supports the 220 kV Gould-Sylmar circuit, with the pair of conductors on the top arm, the pair of conductors on the middle arm, and the pair of conductors on the bottom arm corresponding to the A, B, and C phases, respectively.

On February 16, 2019, SCE performed detailed inspections on towers M2-T4, M2-T5, M2-T6, and M5-T2 that resulted in the following notifications:

a.) Tower M2-T4: Right of way road need grading.
b.) Tower M2-T5: Right of way road need grading.
c.) Tower M2-T6: Right of way road need grading.
d.) Tower M5-T2: Replace damaged insulator (a chipped insulator)

An explanation of SCE's detailed inspection procedures is contained in Appendix A.

In June 2019, SCE patrolled towers M2-T4, M2-T5, M2-T6, and M5-T2. The patrols did not result in any new notifications. An explanation of SCE's patrol procedures is contained in Appendix A.

On October 10, 2019, at approximately 8:57 PM, the insulator Y-clevis end fitting supporting the B phase conductor of the 220 kV Gould-Sylmar circuit failed. This caused the B phase conductor to fall onto the underbuilt steel arm supporting the C phase conductor of the 220 kV Gould-Sylmar circuit (see Figure 3). The contact between the B phase conductor and the steel tower caused a B-phase-to-ground fault on the 220 kV Gould-Sylmar circuit, which in turn caused the

circuit to relay to lockout (note: there is no evidence to suggest that the B phase conductor contacted the C phase conductor). The fault magnitude varied from 18,700 Amperes to 7,300 Amperes. The total fault clearing time was 3 cycles, or 0.05 seconds. The 220 kV Eagle Rock-Sylmar circuit did not relay or lockout.

On October 10, 2019, shortly after 9:00 PM, Robert Delgado, who resides at 14000 Saddle Ridge Road, observed from the window of his home that a fire had ignited near the base of SCE tower M2-T5, located in an open field approximately 2.1 miles upstream from M5-T2 (see Figure 3 for relative locations of SCE towers M2-T5 and M5-T2). This fire would later be named the "Saddle Ridge Fire". The Saddle Ridge Fire eventually consumed 8,799 acres, damaged 88 structures, destroyed 19 structures, injured 8 personnel and civilians, and resulted in one fatality of a civilian due to a heart attack.

From October 10, 2019 to October 12, 2019, SCE completed the following repairs:

- Tower M2-T3: SCE replaced 2 broken insulator units on the bottom phase insulator.
- Tower M2-T6: SCE replaced skyline jumper loop (jumper wire)
- Tower M3-T5: SCE replaced 1 broken unit on the bottom phase insulator.
- Tower M4-T2: SCE replaced 8 broken insulator units on the bottom barreled insulator.
- Tower M5-T4: SCE replaced 1 broken unit on the top phase insulator.
- Tower M5-T2: SCE replaced three insulator strings on the Gould-Sylmar 220 kV circuit.
- SCE washed the insulators on the towers near Tower M2-T5.

On October 14, 2019, ESRB staff inspected towers M2-T5 and M5-T2. The location of Tower M5-T2 is shared with a landscaping business, OWR Nursery. According to Enrique Camacho, an employee of OWR Nursery, shattered pieces of insulator debris were discovered on the ground. The insulator debris is consistent with the B phase insulator on tower M5-T2 falling onto the C phase tower arm. A video recording from the surveillance camera located on the northside of the office building of OWR Nursery did not capture the event but recorded the weather condition at the time of the incident. The weather was windy but there is no indication that the wind was abnormal to the area based on known local conditions.

SCE Tower M5-T2 was constructed and designed in 1970 with a wind load of 8 pounds per square foot (psf) as defined in General Order (GO) 95, Rule 43.2: Light Loading. However, SCE provided a wind load map used for pole loading that indicated that tower M5-T2 was in a known 18 psf wind load area at the time of the incident (Figure 4). In its response to data request response no. 2, question 11, SCE stated, "Tower 5/2 is located in the Yellow = 18# - 84 mph wind loading tier. The yellow tier is the second highest of the five wind loading tiers." While this wind load map was not used for towers, it should be noted that wind speeds generally increase with height above ground due to reduced friction with the ground. As a result, conductors installed on towers are usually exposed to higher wind speeds than conductors installed on poles.

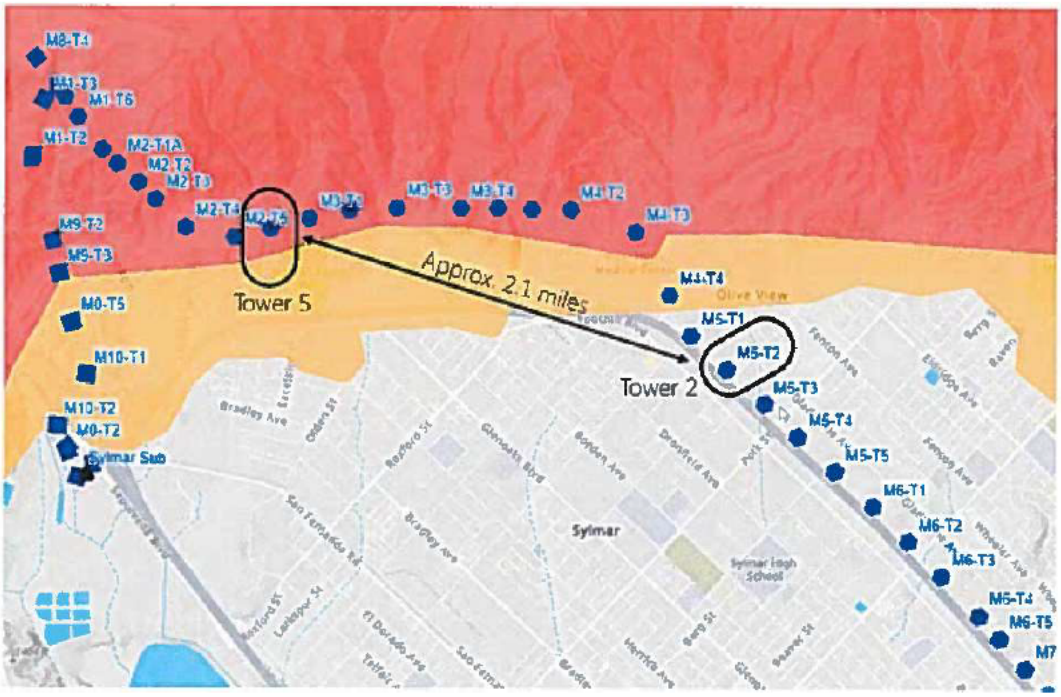
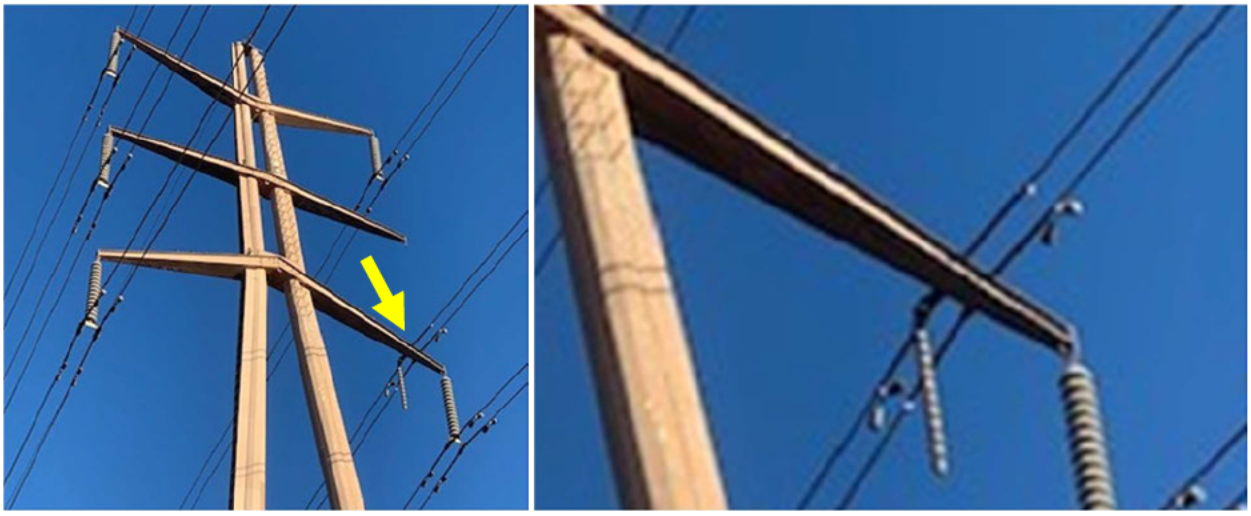


Figure 1: an illustration in SCE's final report showing the locations of towers M2-T5 and M5-T2. We also see towers M2-T4 and M2-T6 located to the left and right of tower M2-T5, respectively.



Figures 2 and 3: A photograph of tower M5-T2 showing the middle B phase conductor that fell onto the lower supporting arm on October 11, 2019 (source: Enrique Camacho of OWR Nursery, 14220 Tyler Street, Sylmar). The yellow arrow was added to identify the contact location of the 220 kV conductor and the lower tower arm.

On October 25, 2019, ESRB inspected evidence at an SCE service yard. One of the items collected was the Y-clevis end fitting that was used to hold the ceramic string insulator onto the B-phase arm of tower M5-T2. The broken ends of the Y-clevis end fitting showed signs of fatigue, e.g., beach marks, and corrosion on the fracture surface (see Figure 5). SCE indicated that it believes that the Y-clevis end fitting, likely a Lindsey brand fitting forged from galvanized steel, was installed in 1970 and had an expected service life of 100+ years.

ESRB inspected three of the four wind dampers that were originally supported on the B phase conductor; however, one of the wind dampers was not inspected as SCE did not retrieved it.

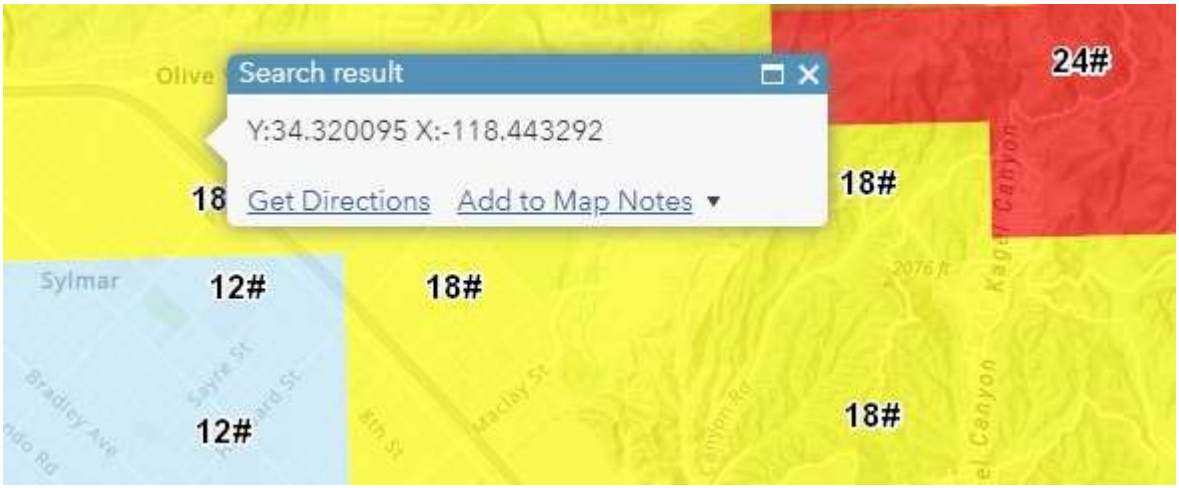


Figure 4: SCE wind loading map used for pole loading with GPS coordinates of tower M5-T2.

Figure 5: a photograph taken on October 25, 2019, at the evidence inspection at the SCE service yard, shows corrosion on the failed section of Y-clevis that supported the B-phase 220 kV conductor on tower M5-T2.

Another piece of evidence that ESRB considered from a photograph from the Los Angeles Fire Department (see Figure 6). The photograph shows unusual burning on the footing on Tower M2-T4, which is one tower away from Tower M2-T5[1].

[1] LAFD Fire Investigation Report No. 2019-10-0664 states, "additional towers were surveyed for damage. At Tower 2/4, I observed high heat burn patterns at its base including spalling of the concrete. These patterns did not appear to be consistent with the fuel load and fuel arrangement in this area. It is possible the damage may be related to the catastrophic failure at Tower 5/2."

Figure 6: LAFD photograph showing evidence of unusual burning on one of the footings on Tower M2-T4.

On November 7, 2019, SCE performed a foundation resistance test on tower M5-T2 and obtained resistance values of 0.552 Ω, 0.611 Ω, and 0.799 Ω at 150 feet, 300 feet, and 450 feet from the base of the tower.

On November 25, 2019, SCE performed a foundation resistance test on tower M2-T5 and obtained resistance values of 0.704 Ω, 0.755 Ω, and 0.928 Ω at 150 feet, 300 feet, and 450 feet from the base of the tower.

On November 26, 2019, SCE performed a foundation resistance test on tower M2-T4 and obtained resistance values of 0.455 Ω, 0.488 Ω, and 0.641 Ω at 150 feet, 300 feet, and 450 feet from the base of the tower.

On November 3, 2023, ESRB obtained a copy of Los Angeles County Fire Department (LAFD) Fire Investigation Report No. 2019-10-0664 dated June 29, 2023. The report states in part:

> *Based upon the witness statements, fire pattern indicators and surveillance video, I formed the opinion the fire started near the base of Southern California Edison (SCE) Tower 2/5 along the Gould-Sylmar 220 kV transmission line. After finding no evidence of any criminal activity, I formed the opinion this is an accidental fire. About three minutes before the fire was reported, Tower 5/2, on the same transmission line, experienced a catastrophic failure of an idler insulator causing the B phase to ground fault during high winds. It is outside my expertise to opine if this catastrophic failure could cause high voltage to travel back through the conductors or lighting wire on the top of the towers and cause a fire, possibly through the tower's grounding system, at the base of Tower 2/5. Therefore, the cause of the fire will be undetermined.*

GO 95, Rule 31.1: Design, Construction and Maintenance, states in part:

> *Electrical supply and communication systems shall be designed, constructed, and maintained for their intended use, regard being given to the conditions under which they are to be operated, to enable the furnishing of safe, proper, and adequate service.*

GO 95, Rule 44.3: Replacement, states in part:

> *Lines or parts thereof shall be replaced or reinforced before safety factors have been reduced (due to factors such as deterioration and/or installation of additional facilities) in Grades "A" and "B" construction to less than two-thirds of the safety factors specified in Rule 44.1 and in Grade "C" construction to less than one-half of the safety factors specified in Rule 44.1.*

ESRB discovered two instances in which SCE was in violation of GO 95, Rules 31.1 and 44.3:

1. **Broken skyline jumper wire on M2-T6**: The photograph in Figure 7, taken on October 12, 2019, of tower M2-T6, located just east of M2-T5, showed a broken skyline jumper wire. The "skyline" (alternatively referred to as a "static line" or "shield wire") has multiple functions, including directing lightning strikes to ground, contributing to the grounding system during a fault event, and supporting communications cables. After the incident, SCE discovered and repaired the broken skyline jumper wire. SCE indicated that a skyline jumper wire provides an optimal path but is not necessary when there are no insulators on the skyline. However, because SCE chose to install a jumper wire on the skyline, SCE is required to ensure that the jumper is maintained. SCE is in violation of GO 95, Rule 31.1 for failing to design, construct, and maintain the skyline jumper wire so that it will not break under normal operating conditions. Additionally, SCE is in violation of GO 95, Rule 44.3 for failing to ensure that the skyline jumper wire maintained a minimum safety factor of 1.33.

2. **Broken Y-clevis end fitting on M5-T2**: In this incident, the Y-Clevis end fitting on tower M5-T2 failed, causing the B-phase conductor it was supporting to fall onto an underbuilt steel arm. SCE is also in violation of GO 95, Rule 31.1 for failing to design, construct, and maintain the Y-clevis end fitting for its intended use so that it will not break under normal operating conditions. Additionally, SCE is in violation of GO 95, Rule 44.3 for failing to ensure that the Y-clevis end fitting maintained a minimum safety factor of 1.33.

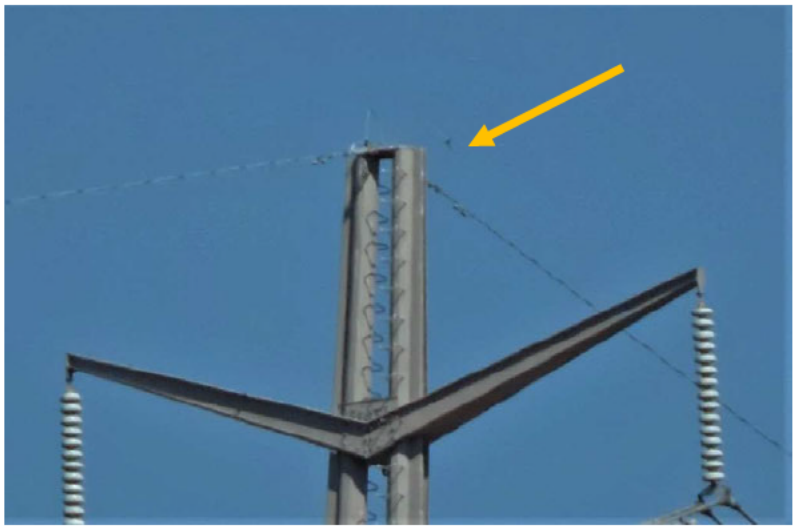


Figure 7: A photograph of Tower M2-T6 with an arrow pointing to the detached skyline on the top of the tower.

GO 95, Rule 48.2: Structural Material (other than wood) [revised March 30, 1968 by Decision No. 73813 and applicable to a structure installed in 1970] states in part:

> *Structural members and their connections, shall be designed and constructed so that the structures and parts thereof will not fail or be seriously distorted at any load less than the maximum working loads developed under the construction arrangement with loadings as specified in Rule 43) multiplied by the safety factors specified in Rule 44.*

In this incident, the Y-clevis end fitting on tower M5-T2 failed, causing the B-phase conductor it was supporting to fall onto an underbuilt steel arm. The steel Y-clevis end fitting is a member of the tower structure. Together with other components, the Y-clevis end fitting is intended to provide the structural support needed to hold an overhead conductor safely and securely. The Y-clevis end fitting is one of the most vital members of the tower structure because it is the only component that attaches the string insulator and associated conductor to the steel arm (meaning there are no redundant components that can assume the structural load of the Y-clevis end fitting if the Y-clevis end fitting was to fail). Since tower M5-T2 was installed in 1970, the rule that governed the design and construction of steel structural members and their connections would have been GO 95, Rule 48.2: Structural Material, revised on March 30, 1968 by CPUC Decision No. 73813. This rule required utilities to design and construct structural members and their connections in such a way that the structure or parts thereof will not fail or become seriously distorted at any load less than their maximum working loads multiplied by the applicable safety factor. For the date and time during which the Y-clevis end fitting failed, there is no evidence to suggest that loading conditions were abnormal or in any way greater than the maximum working load multiplied by the applicable safety factor. Therefore, SCE is in violation of GO 95, Rule 48.2 [revised March 30, 1968 by Decision No. 73813 and applicable to a structure installed in 1970] for failing to design and construct the Y-clevis end fitting in such a way that it would not fail or be seriously distorted at any load less than the maximum working load multiplied by the safety factor in Rule 44.

Although the LAFD Fire Investigation Report states that the cause of the fire is undetermined, ESRB notes that the General Order 95 violations listed above, under certain circumstances, could have led to a fire ignition.

Preliminary Statement of Pertinent General Order, Public Utilities Code Requirements, and/or Federal Requirements:

	General Order	*GO Rule*	*Violation*
1.	GO 95	Rule 31.1	Yes
2.	GO 95	Rule 44.3	Yes
3.	GO 95	Rule 48.2	Yes

Conclusion:

ESRB's investigation discovered 5 violations on the part of SCE:

- SCE is in violation of GO 95, Rule 31.1 for not maintaining the skyline jumper wire on tower M2-T6 for its intended use.
- SCE is in violation of GO 95, Rule 44.3 for failing to ensure that the skyline jumper wire on tower M2-T6 maintained a minimum safety factor of 1.33.
- SCE is in violation of GO 95, Rule 31.1 for failing to maintain the Y-clevis end fitting on tower M5-T2 for its intended use.
- SCE is in violation of GO 95, Rule 44.3 for failing to ensure that the Y-clevis end fitting on tower M5-T2 maintained a minimum safety factor of 1.33.
- SCE is in violation of GO 95, Rule 48.2 [revised March 30, 1968 by Decision No. 73813 and applicable to a structure installed in 1970] for failing to design and construct the Y-clevis end fitting on tower M5-T2 in such a way that it would not fail or be seriously distorted at any load less than the maximum working load multiplied by the safety factor in Rule 44.

Appendix

In the Southern California Edison Company Grid Operations and Maintenance Division, "Maintenance Practices for Transmission Facilities under the Control of the California Independent System Operator (ISO)", several of the versions provided in data request no. 2 mentioned the use of climbing for detailed inspections.

Original Version - December 23, 1997, Revision 1 - January 8, 2001, Revision 2 – January 3, 2002, Revision 3 – December 31, 2005, defines the term detailed inspection, and describes inspections methodologies as follows:

> ***3.3.1 – Detailed*** *– A definitive maintenance inspection to follow up abnormal conditions identified during a routine inspection of a Transmission Facility.*
>
> ***5.1.1.1 – Establishment of Inspection Frequency -*** *The nature, extent, and priority of the detailed inspection will be established and scheduled by the supervisor. The Detailed Inspection may incorporate climbing the transmission structure or the use of diagnostic assessments, such as infrared scanning, and provide an in-depth analysis of the suspected problem. Detail inspections are performed on an as-needed basis.*
>
> ***5.1.1.2 – Inspections Methodologies*** *–Detailed (climbing) inspections, such as checking lattice steel towers for loose steel or worn hardware, are performed on an as-needed basis.*

Revision 4 – January 2011, defines the term detailed inspection, and describes inspections methodologies stated in part as the following:

> ***3.6 – Detailed (Transmission)*** *– A systematic, technical appraisal or diagnostic testing of facilities*
>
> ***5.1.2.3 - Detailed Inspection -*** *often accomplished by climbing support structures or towers to identify broken, missing or worn hardware. Also includes, but is not limited to the excavation of soil, intrusive testing of wood poles and performing infrared scans.*

Revision 6 – February 7, 2018, mentioned the inspection frequency in addition to the ascending and descending of towers of detailed inspections in table 5.1.3 Frequency. Per row "Overhead Lines and Communication Circuits" and column "Detailed Inspections" of the table, detailed inspections are to be conducted every 36 months, with superscript 7 stating "*Lattice towers in high-wind areas are (to)be subject to additional Maintenance, including but not limited to ascending/descending towers, ringing steel members, and tightening hardware.*".

> ***3.5 – Detailed*** *- A careful visual assessment performed in close proximity to or while upon a structure for the purpose of identifying, prioritizing, and recording discrepancies. This activity includes performing minor or temporary repairs during the inspection and special technical evaluation as needed.*

> ***5.1.2.3 - Detailed Inspection*** *- A close proximity assessment to identify broken, missing or worn conductors, insulators, or hardware. This activity includes the excavation of soil, and testing poles and structures.*

Revision 7 effective: 06/01/2021. The procedure document was signed after the effective date but mentions under Section 7 Revision History a letter from CAISO that "confirms" implementation of Revision 7 to be effective as of 06/01/2019, prior to the date of the incident. Revision 7 defines detailed inspections and methodology as the following (and, as in Revision 6, defines the detailed inspections to 36 months):

> ***3.5 - Detailed -*** *A careful visual assessment performed in close proximity to or while upon a structure for the purpose of identifying, prioritizing, and recording discrepancies. This activity includes performing minor or temporary repairs during the inspection and special technical evaluation as needed.*

> ***5.1.2.3 - Detailed Inspection*** *- A close proximity assessment to identify broken, missing or worn conductors, insulators, or hardware. This activity includes the excavation of soil, and testing poles and structures*

On February 16, 2019, prior to the incident, SCE performed detailed inspections on towers M2-T4, M2-T5, M2-T6, and M5-T2. SCE inspectors performed detailed inspections while standing on the ground and using binoculars. No additional tools were used.

In June 2019, prior to the incident, SCE patrolled towers M2-T4, M2-T5, M2-T6, and M5-T2. The patrols consisted of visual inspections from ground level.