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

Incident Investigation Report

Report Date: 4/15/2016

Incident Number: E20150801-01

Utility: SCE

Date and Time of the Incident: 8/1/2015, 9:36:00 AM

Location of the Incident: Near Desert Knoll Avenue & Valle Vista Rd.
Twentynine Palms, CA
County: San Bernardino

Summary of Incident:

[redacted] were riding off road vehicles on a dirt road in Twentynine Palms, when [redacted] struck a low-hanging, energized SCE 12 kV overhead conductor, injuring himself. While providing aid to [redacted] contacted the energized SCE conductor, injuring themselves. SED's investigation found that the above ground clearance of the SCE conductor did not meet the GO 95 minimum requirement.

Fatality / Injury: There were 3 injuries reported.

Property Damage: None Reported

Utility Facilities involved: North Adobe, 12 kV Circuit

Witnesses:

	Name	*Title*	*Phone*
1	Koko Tomassian	SED Utilities Engineer	(213) 576-7099
2	Derek Fong	SED Senior Utilities Engr.	(213) 576-6850
3	[redacted]	[redacted]	[redacted]
4	[redacted]	[redacted]	
5	[redacted]	[redacted]	
6	[redacted]	[redacted]	
7	[redacted]	[redacted]	[redacted]

Evidence:

	Source	*Description*
1	SCE	Initial Utility Report, 8/1/2015
2	SED	Field Visit, 8/1/2015
3	SCE	Final Utility Report, 8/28/2015
4	SED	Data Request 1, 1/27/2016
5	SED -SCE	Witness Interviews, 2/17/2016
6	SCE	Data Request 1 Response, 2/25/2016
7	SED	Data Request 2, 3/22/2016
8	SCE	Data Request 2 Response, 4/8/2016
9	SED - [redacted]	Phone Interview, 3/1/2017

Observations and Findings:

On July 29, 2015, the Twentynine Palms region began experiencing thunderstorms. The storm resulted in the activation of SCE's normal emergency operations at the local district level. In a letter dated February 24, 2016, SCE indicated that wind gusts from the thunderstorms were estimated to have reached speeds of approximately 70 mph, with gust fronts stretching up to five miles.[1] However, MesoWest Station ID KTNP[2], located 7.14 miles away from the incident site, recorded the highest wind gust and wind speed from July 29, 2015 at 0100 hours to August 1, 2015 at 0900 hours to be 40 miles per hour and 30 miles per hour, respectively.

On July 30, 2015, due to reports of outages on the Sheephole 33 kV circuit out of SCE's High Desert substation – the longest circuit in SCE's service territory – [redacted] assigned several damage assessment teams (DATs) to assess and perform storm damage control on the Sheephole 33 kV circuit. A DAT is typically comprised of a troubleman, a planner, and a work assignment coordinator. The troubleman performs troubleshooting and provides repair estimates. The planner assesses damages, necessary repairs, and materials, and ensures pole load calculations are completed and in compliance with General Order (GO) 95 requirements. The work assignment coordinator, typically an analyst or production specialist, plans and coordinates the repairs per the troubleman and planner's assessment.

In response to reports from DATs of widespread damage, inaccessible roads, and other logistical considerations, [redacted] ordered an SCE helicopter to conduct a patrol inspection of the Sheephole 33 kV circuit. The patrol revealed extensive crossarm damage over a large area on the Sheephole 33 kV circuit, which resulted in the helicopter troubleman requesting DATs be dispatched to the area when weather and road conditions permitted to further investigate the Sheephole 33 kV circuit.

[1] Report from Jay Rosenthal of Air, Weather, and Sea Conditions Inc. in SCE's Data Request Response, dated Feb. 24, 2016.

[2] Data courtesy of Meteorological Assimilation Data Ingest System (MADIS), operated by the National Weather Service (NWS) National Centers for Environmental Prediction Central Operations.

On August 1, 2015, at 0932 hours, the California Highway Patrol (CHP) received a report of a traffic collision at the incident area. At 0941 hours, CHP Officer Eric Gonzalez arrived at the scene, spoke with [redacted], and learned that the following had occurred[3]: [redacted], [redacted] and [redacted], all active off duty US Marine Corps officers, were riding off road vehicles [redacted] was riding on a motorcycle, followed by [redacted] and [redacted] on quads) when [redacted] by a low hanging SCE conductor, which [redacted] pulled him off his motorcycle. [redacted] and [redacted] rushed to [redacted] aid, and in an attempt to lift the conductor from [redacted], while [redacted] called 911 after the incident. [redacted] was [redacted], while [redacted] SED staff (Staff) also interviewed [redacted] and learned that neither he nor his companions [redacted] saw the low-hanging conductor prior to contacting it. [redacted] stated that it was not until he "[redacted]" [redacted] shortly after the accident that he realized the contacted object was an electric conductor.

At approximately 1030 hours, after receiving a call from the Twentynine Palms Fire Department, [redacted] who had been performing damage assessment on the Sheephole 33 kV circuit, responded to the incident location and observed three injured males and a low-hanging conductor on a branch of the North Adobe 12kV circuit out of Twentynine Palms substation. The CHP and the Twentynine Palms Fire Department were already on-scene.

Later the same day, Staff visited the incident site and discovered the following: A 10 foot crossarm on pole number 43502S was broken (see Figure 1), and part of the crossarm and an insulator that was originally installed on the crossarm was on the ground near the base of the pole (see Figure 2)[5]. The south phase conductor of a branch of the North Adobe 12kV circuit (AWG No. 6 stranded copper conductor), which was initially supported by the insulator was lying on the ground, on bushes, and on top of [redacted] motorcycle (see Figure 3). The conductor was broken into two pieces, and the two broken ends of the conductor exhibited signs of necking (necking indicates that the conductor's cross-sectional area has begun to decrease in a particular region as a result of tensile stress). The seat height of [redacted] motorcycle (2015 Kawasaki KMX) was approximately 2.8 feet.

[3] California Highway Patrol Report No. 201501210.

[4] SED phone interview on March 1, 2017.

[5] On August 2, 2015, the day after the incident, SCE completed repairs to pole number 43502S.

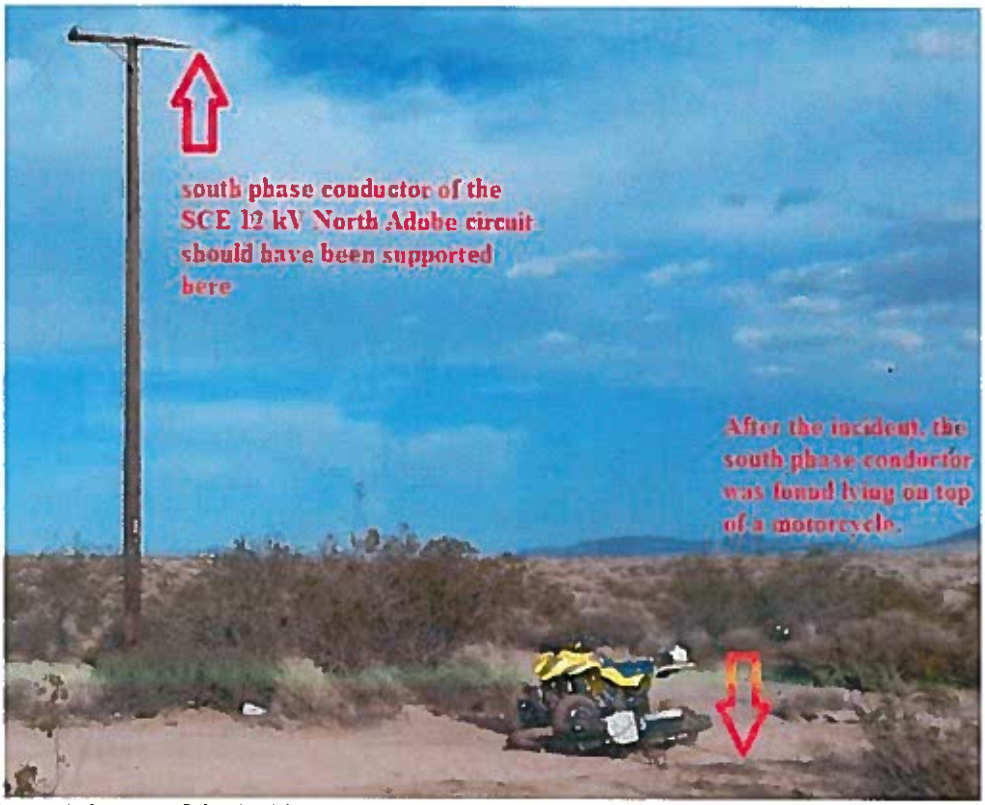


Figure 1. Image of the incident site showing the broken crossarm on Pole number 43502S.

Figure 2. The left and right images show the insulator and crossarm that were supported on pole number 43502S.

Figure 3. The south phase conductor of the SCE 12 kV North Adobe circuit was found on top of a motorcycle.

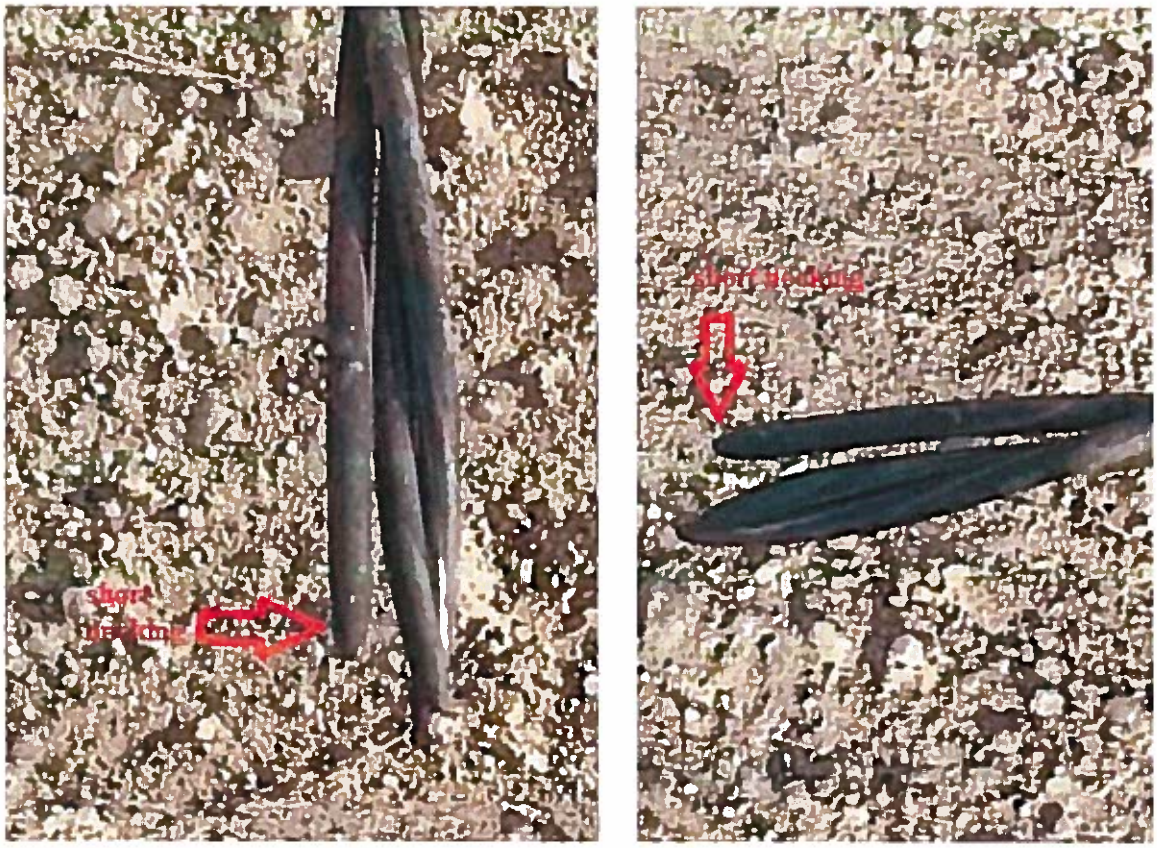


Figure 4. After the incident, the south phase conductor of the SCE 12 kV North Adobe circuit was found broken into two pieces and lying on the ground. The broken ends of the conductor exhibit short necking.

Aside from the Staff field visit notes, Staff also examined/considered the following evidence:

1. The CHP report[6] noted that [redacted] and [redacted]. Additionally, the responding officer obtained a witness statement in which [redacted] stated that [redacted] was struck by a low hanging power line [redacted] pulling him back.
2. Pole number 43502S exhibited several fresh scratches on the face of the pole at 4.8 feet, 6.6 feet, and 8 feet from the ground (see Figure 6).
3. The two broken ends of the conductor exhibited signs of necking, which may indicate that the conductor broke due to tension. This is consistent with [redacted] striking the conductor, and the force of the collision may have pulled apart the conductor.
4. [redacted] is [redacted] tall. Based on a seat height of 2.8 feet, [redacted] maximum height while seated on the motorcycle would have been 5 feet, 7 inches. If [redacted] had been standing on the foot rest of the motorcycle (~1 foot above the ground), his maximum height would have been 7 feet, 3 inches. This information is consistent with the conductor having an above ground clearance less than 8 feet.
5. SCE's helicopter patrols found crossarm damage in the storm area.
6. In SCE's initial incident report, SCE indicated that at 0936 (at approximately the time of the incident), the subject circuit relayed, tested, and locked out. This could indicate that a fault occurred when [redacted] hit the conductor, and when [redacted] and [redacted] tried to remove the downed conductor, the relay tested, determined that the fault did not clear (still present), locked out, and permanently de-energized the conductor.
7. Prior to the incident, SCE did not receive any complaints regarding service outages or downed conductors from customers on the subject branch of the North Adobe 12 kV circuit.

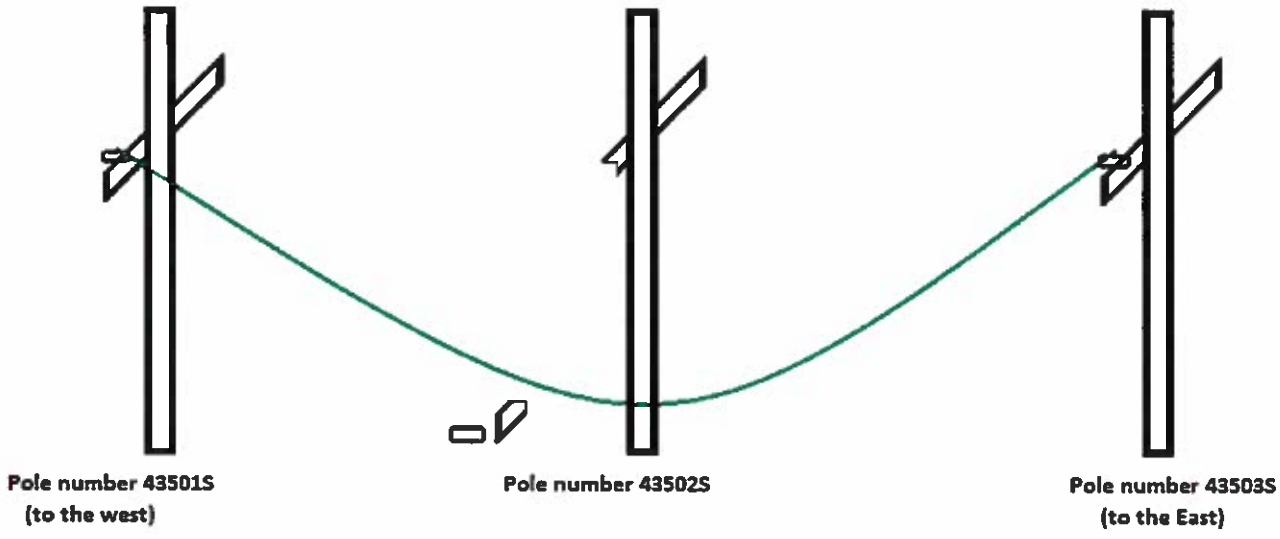


Figure 5: Configuration of SCE facilities just prior to the incident. The crossarm on Pole number 43502S was broken, causing the south conductor to be supported by Poles numbered 43501S and 43503S.

[6] California Highway Patrol Report No. 201501210.

Figure 6: A scratch mark on Pole number 43502S.

On February 17, 2016, Staff interviewed [redacted] the [redacted], [redacted] and [redacted], and discovered the following: SCE typically becomes aware of system issues through few channels. One method for identifying system issues is through outage notifications. Outage notifications can come from customer calls indicating no service, or from information gathered by protective devices (e.g. automatic reclosers, relays, pull switches, etc.) that can detect and indicate service issues. The other manner in which SCE is notified of system issues is through trouble notifications received directly from the public or other agencies (e.g. fire department, police, etc.). Typically, outage or trouble notifications come with distinguishing information, such as the circuit name, the part of the circuit, protective device asset number (e.g. beyond pull switch 123), or a more precise location if automatic protective devices are installed. Once identifying characteristics are assigned, a troubleman will then patrol that particular circuit. Only in cases where there is severe widespread damage will the troubleman also patrol tap lines or branches off of the originally identified circuit.

SCE did not patrol the North Adobe 12kV circuit (where the incident occurred) because there were no outage notifications, either from customers or from the circuit's protective devices. Also, this circuit branch of the North Adobe 12kV circuit only fed three customers, none of which had called to report any issues with their electric service, which would have prompted an SCE patrol of that particular segment.

Prior to the incident, SCE detail inspected Poles numbered 43501S, 43502S, and 43503S in October 2011 and patrolled them in December 2014. The poles had the following history:

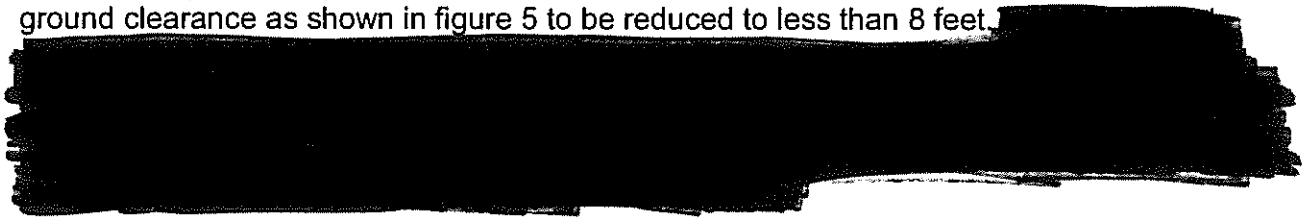
- Pole number 43501S:

- On October 13, 2011, SCE detail-inspected the pole and created a work order notification[7] to "INSTALL MISSING PRI HIGHSGN POLE". SCE assigned the notification a Priority level 3, which SCE refers to as "opportunity maintenance" in its current priority level rating system. The notification did not have a specific required end date.
- On August 2, 2015, the day after the incident, SCE completed the work order to install high voltage signs.

- Pole number 43502S:

  - On September 19, 2002, SCE detail-inspected the pole and created a work order notification to "REPLC DAMAGE PRI HIGHSGN POLE". SCE assigned the notification a Priority level 5, a level SCE referred to as "opportunity maintenance" in its previous priority level rating system (SCE changed rating systems in 2010), with no specific required end date.
  - On April 20, 2010, SCE updated the notification's priority level from Priority level 5 to Priority level 3 (SCE's level for "opportunity maintenance" in its current priority level rating system), again with no specified required end date.
  - On October 17, 2010, SCE detail-inspected the pole and updated the notification's reference date to the detailed inspection date.
  - On October 13, 2011, SCE detail-inspected the pole.
  - On August 2, 2015, the day after the incident, SCE completed the work order to install high voltage signs.

Based on the evidence, Staff concludes that it is likely that prior to the incident, the crossarm on pole number 43502S broke, causing the south phase conductor of the subject branch of the SCE 12 kV North Adobe circuit – which was supported on the aforementioned pole – to become supported by poles numbered 43501S and 43503S. This caused the conductor's ground clearance as shown in figure 5 to be reduced to less than 8 feet.



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.*

[7] A pending notification refers to an open work order that is awaiting completion.

Crossarms should be designed, installed, and maintained properly to prevent failure during conditions that are normal to the area where they are installed. There are no indications that there were any abnormal conditions at or just before the time of the incident that could have caused a properly designed, installed, and maintained crossarm to break. The crossarm on SCE pole number 43502S failed and broke, causing a piece of the crossarm and an insulator to fall to the ground. This resulted in a 12 kV overhead conductor supported on the crossarm to fall down and become suspended to less than 8 feet above the ground. Therefore, SCE is in violation of GO 95, Rules 31.1, for failing to ensure that the crossarm it installed does not break during conditions normal to the area.

GO 95, Rule 48, Strength of Materials, states:

> *Structural members and their connection shall be designed and constructed so that the structures and parts thereof will not fail or be seriously distorted at any load less than their maximum working loads (developed under the current construction arrangements with loadings as specified in Rule 43) multiplied by the safety factors in Rule 44. Values used for the strength of material shall comply with the safety factors specified in Rule 44.*

The above rule requires utilities to ensure that a crossarm is designed, installed, and constructed so that it does not fail or become seriously distorted at any load less than its maximum working load multiplied by the safety factors in Rule 44[8]. There are no indications that there were any abnormal conditions at or just before the time of the incident that could have caused a properly designed, installed, and maintained crossarm to break. In a letter dated February 24, 2016, SCE indicated that, per its consultant, wind gusts just prior to the incident reached approximately 70 mph. Data provided by the National Weather Serviced showed that the highest wind gusts were 40 mph. Nonetheless, the crossarm failed at wind speed less than 82.2 mph. Therefore, SCE is in violation of GO 95, Rule 48, for failing to ensure that its crossarm did not fail or become seriously distorted at a load that was less than the maximum working load multiplied by the safety factor in Rule 44.

GO 95 Rule 37, Minimum Clearances of Wires above Railroads, Thoroughfares, Buildings, Etc., states in part:

> *Clearance between overhead conductors, guys, messengers or trolley span wires and tops of rails, surfaces of thoroughfares or other generally accessible areas across, along or above which any of the former pass; also clearances between conductors, guys, structures, or other objects, shall not be less than those set forth in Table 1, at a Temperature of 60°F and no wind…*

The above rule requires supply conductors of 750-22,500 volts installed above ground along

[8] For a wood crossarm, the maximum working load would be a wind pressure of 13 lb_f/ft^2 [for flat surfaces, per GO 95, Rule 43.2-A] and the safety factor would be 1.33 [per GO 95, Rule 44.3], which would yield a wind speed of 82.2 miles per hour (this is the wind speed that the crossarm shall be able to withstand).

thoroughfares in rural districts or across other areas capable of being traversed by vehicles or agricultural equipment to maintain a minimum ground clearance of 25 feet. At the time of the incident, the SCE overhead conductor had an above ground clearance less than 8 feet, which is less than the GO 95 minimum requirement of 25 feet. Therefore, SCE is in violation of GO 95, Rule 37 for failing to ensure that its 12 kV overhead conductor maintained at least a 25 foot ground clearance above a thoroughfare capable of being traversed by vehicles.

GO 95, Rule 51.6-A, High Voltage Marking of Poles, states in part:

> *Poles which support line conductors of more than 750 volts shall be marked with high voltage signs. This marking shall consist of a single sign showing the words "HIGH VOLTAGE", or pair of signs showing the words "HIGH" and "VOLTAGE", not more than six (6) inches in height with letters not less than 3 inches in height. A pair of signs may be stacked to a height of no more than 12 inches. Such signs shall be of weather and corrosion–resisting material, solid or with letters cut out therefrom and clearly legible.*

Pole number 43501S had a damaged high voltage sign on the side of the crossarm facing the incident location. Pole number 43502S was missing a high voltage sign on both sides of the crossarm. Therefore, SCE is in violation of GO 95, Rule 51.6-A for having broken or missing high voltage signs on poles numbered 43501S and 43502S at the time of the incident.

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

	General Order	*GO Rule*
1	GO95	31.1
2	GO95	44.3
3	GO95	37, Table 1 - Case 4E
4	GO95	48
5	GO95	51.6-A

Conclusion:

SED's investigation found that SCE is in violation of the following rules:

1. GO 95, Rule 31.1, for failing to ensure that the crossarm it installed does not break during conditions normal to the area.
2. GO 95, Rule 48 for failing to ensure that its crossarm did not fail or become seriously distorted at a load that was less than the maximum working load multiplied by the safety factor in Rule 44.
3. GO 95, Rule 37 for failing to ensure that the overhead conductor supported by pole number 43502S maintained a minimum above ground clearance of 25 feet.
4. GO 95, Rule 51.6-A for failing to ensure that poles numbered 43501S and 43502S supported the appropriate high voltage markings.