ATTACHMENT 1

CALIFORNIA PUBLIC UTILITIES COMMISSION
Consumer Protection and Safety Division
Utilities Safety and Reliability Branch
Preliminary Incident Investigation Report

Report Date: December 17, 2012

Investigator: Mahmoud Intably

Incident Number: E 20110114-01

Utility: Southern California Edison Company (SCE)

Date and Time of the Incident: 1/14/2011, 0550 hours

Location of the Incident: Xxxx Acacia Avenue
San Bernardino,CA
County: San Bernardino

Summary of Incident:

On January 14, 2011, at 0541 hours, two SCE 12 kV overhead conductors (B phase and C phase conductors) came into contact or near contact with each other and caused the C phase conductor to break, fall to the ground, and start a small grass fire. Xxxxxx Xxxx, a resident at Xxxx Acacia Avenue, was electrocuted while trying to extinguish the fire when he contacted a section of the conductor that was lying on the ground. His wife, XxxxxxxXxxx, and his stepson, XxxxxxxxXxxx tried to help XxxxXxxx and were also electrocuted.

Seconds before the fatal incident at Xxxx Acacia Avenue, there was another conductor failure on the same circuit at West Hill Drive, 0.25 miles away from Xxxx Acacia Avenue. Two SCE 12 kV overhead conductors (B phase and C phase conductors) came into contact or near contact with each other and caused the B phase conductor to break and fall to the ground. There were no fires or injuries as the result of this conductor failure.

My investigation found that contact, or near contact, occurred between two SCE 12 kV overhead conductors at two different locations at almost the same time. This caused two SCE 12 kV overhead conductors at two different locations to fail and fall down to the ground. My investigation also revealed that similar conductor failures have been occurring for the past six years on the same circuit and in the proximity of this incident. However, SCE did not take appropriate measures to prevent such recurrences.

Fatality / Injury: There were three fatalities

Property Damage: $74,918

Utility Facilities involved: 12 kV Vargas Circuit in Redlands District

Witnesses:

Name	Title
Aurelia Baker	SCE-Claims Senior Representative
Robert Ramos	SCE-Claims Manager
Paul Pimentel	SCE-Claims Representative
Glenn Tomas	SCE-Claims Representative
Gary Fowler	Metallurgical Consultant
Michael Hinckley	SCE-Troubleman
Steve Reyes	SCE-Substation Operator
Kyle Elliott	SCE-Substation Operator
Chris Almaraz	SCE-Substation Operator
XxxxxxXxxx	XxxxxxxXxxxx daughter
XxxxxXxxxxxx	Friend of XxxxxxxXxxx
XxxxxxXxxx	XxxxxxxXxxxx brother
Carlos Fernandez-Pello	SCE Consultant
T C Cheng	SCE Consultant

Evidence:

Source	Description
SCE	Initial Report
SCE	Response letters to various CPSD data requests
Weather Underground	Historic data of wind speed
California State University San Bernardino	Data from weather station located near the accident site
San Bernardino Police Department	Police Department Forensic Report
San Bernardino Fire Department	Incident Report
San Bernardino County Sheriff's Department Coroner	Coroner Report

Observations and Findings:

The 12 kV Vargas Circuit involved in this incident consists of three different phase conductors and a neutral conductor. A relay and a circuit breaker protect the 12 kV Vargas circuit from overcurrent conditions. The relay is a protective device that monitors current on the circuit and sends a signal to the breaker to interrupt power when it detects an overcurrent condition. The relay waits 15 seconds and sends another

signal to the breaker to re-energize the circuit. If the fault current is still present, the breaker opens and interrupts the power again, however, if the fault is cleared, the breaker stays closed and the circuit remains energized.
On January 14, 2011, at 0541 hours, the 12 kV Vargas Circuit relayed (opened and de-energized the circuit) due to a phase to phase fault and a phase to ground fault between the B and C phase conductors at two different locations. The fault was due to a contact (or near contact) between the B phase and the C phase conductors at both locations. The contact at the site of the incident produced an arc between the two conductors and caused the C phase conductor to break at mid-span between poles numbered 1511596E and 2198978E at Xxxx Acacia Avenue. The load side section of the C phase conductor fell on a tree and a grassy area in the backyard of Xxxx Acacia Avenue and started a small grass fire. The source side section of the C phase conductor fell on a composite roof of an adjacent property at Xxxx Acacia Avenue.

Seconds before the Acacia Avenue incident, contact, or near contact, between the B and C phase conductors at West Hill Drive caused the B phase conductor to break and fall to the ground. However, the tap connecting the B phase conductor to its source across the crossarm also failed, thus, separating the B phase conductor from its source and causing it to be de-energized.

The fault produced by the contact between the B and C phase conductors at both locations must have lasted less than 15 seconds because the circuit was re-energized after the breaker re-closed, and remained energized (the relay did not detect fault current after the breaker re-closed). The contact between the energized source side section of the C phase conductor that was lying on a composite roof did not produce a fault current that is high enough for the relay and breaker to interrupt the circuit. Therefore, all of the conductors, A, B, and source side of C phase conductors were re-energized. The section of the C phase conductor (load side) that was on the ground at the Acacia Avenue incident site should have been de-energized, since it was disconnected from the source. However, the A phase conductor induced electrical current into the winding of the transformer (where the A and the load side C phase conductors connect) onto the load side section of the C phase conductor, causing it to become energized, and starting a small grass fire at the Acacia Avenue property.

Figure 1 shows pole number 1511596E and the connection between the conductors and the transformer.

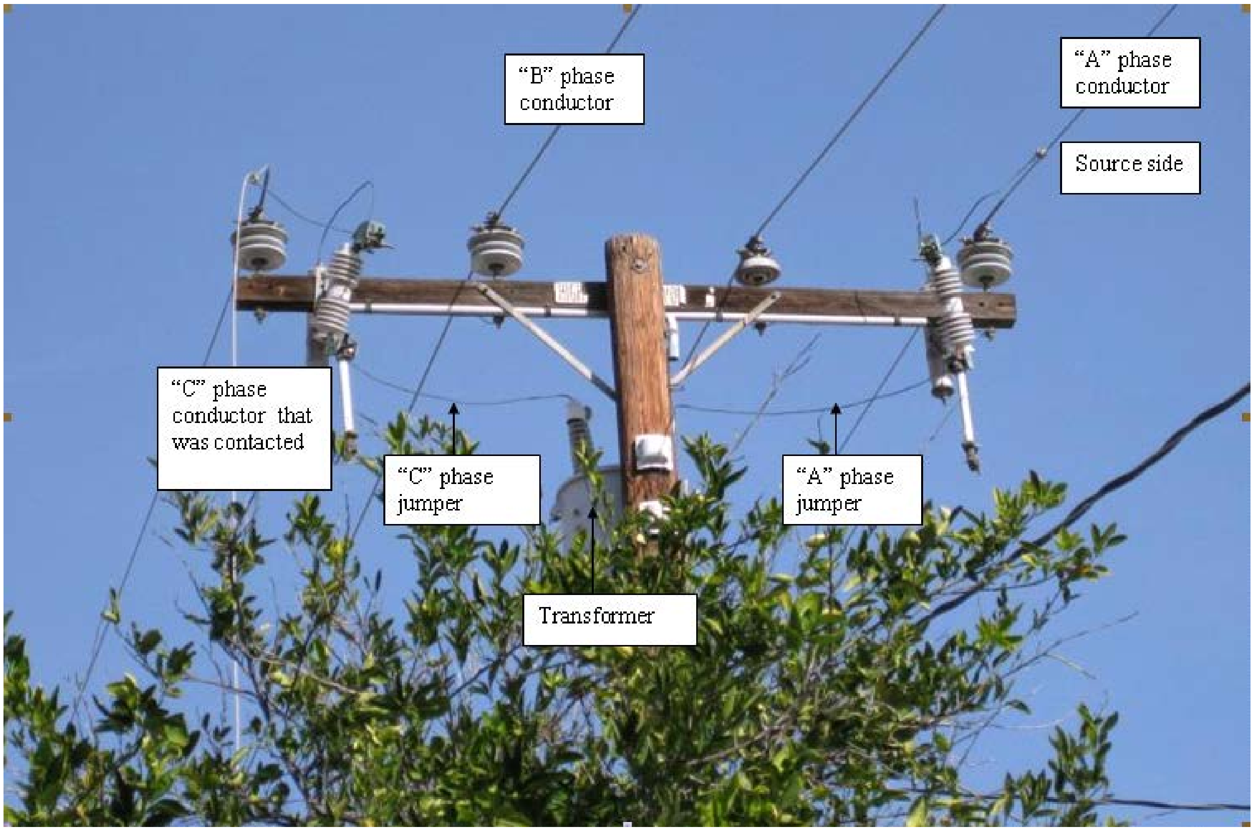

Figure 1
Pole 1511596E

XxxxxxxxxxX, a resident of Xxxx Acacia Avenue, attempted to extinguish the grass fire when he contacted the energized load side section of the C phase conductor that was lying on the grass in his backyard, resulting in his electrocution. XxxxxxxXxxx, Xxx XXxxx wife and XxxxxxxxxXxxx, XxxxXxxxx stepson, were also electrocuted when they tried to help XxxxXxxx.

XxxxxXxxx, XxxxxxxXxxxx daughter, called 911 at 0546 hours and requested help. The San Bernardino Fire Department (SBFD) arrived at the scene at 0556 hours.

At approximately 0557 hours, the wind blew the energized source side section of the C phase conductor that was lying on the composite roof and caused it to contact two SCE triplex service drops and a metal fence around a swimming pool. The relay detected a phase to ground fault and sent a signal to the circuit breaker to interrupt. Approximately 15 seconds later the breaker reclosed and the relay detected that the fault was still present, thus the breaker de-energized the circuit and kept it de-energized.

SBFD notified SCE of the downed conductor at 0612 hours and SCE's representative arrived at the scene at approximately 0700 hours. SCE verified and informed SBFD that the conductor on the ground was de-energized.

Additional Details:

The following events occurred on the 12 kV Vargas Circuit within a few miles from the accident site:

- On January 24, 2006, at 2100 hours, the circuit experienced a fault. SCE patrolled the circuit and did not find any problems.
- On July 31, 2006, the circuit experienced a fault. SCE found an overhead conductor had failed at Xxx West Hill Drive between Louis and Acacia.
- On December 23, 2006, at 0532 hours, the circuit experienced a fault. SCE found that wind blew overhead conductors together.
- On October 21, 2007, at 0719 hours, the circuit experienced a fault. SCE patrolled the circuit and did not find any problems.
- On December 25, 2007, at 0018 hours, the circuit experienced a fault. SCE found that two overhead conductors contacted each other and blew open a tap line. In addition, SCE found downed power lines at pole number 2082638E.
- On March 8, 2008, the circuit experienced a fault. SCE determined that wires arced and caused a primary tap line to break at pole number 1511588E.
- On October 14, 2008, at 0524 hours, the circuit experienced a fault. SCE determined that an overhead conductor failure caused the fault.
- December 29, 2010, 2320 hours, approximately 16 days before the Acacia Avenue incident, the circuit experienced a fault. SCE found a downed overhead conductor attached to pole number X6022E at Xxx Northpark Blvd. In addition, at the West Hill Drive site, SCE found an overhead conductor broke near a connector and the conductor was still hanging in the air. The overhead conductor was spliced and put back in service.
- Spans at the Acacia Avenue incident site had two splices installed on the conductors. The splices could indicate that the circuit had experienced conductor failures in the past prior to this incident. SCE's current practice is not to maintain records for the installation of splices, thus, SCE was not able to locate the records related to the installation of these splices.
- Dr. Carlos Fernandez-Pello, an SCE consultant, examined the B phase conductor from the Acacia Avenue incident site and found multiple old arc marks on the conductor. This indicates that a previous contact or near contact occurred between the B phase conductor and the adjacent phase conductor or a neutral conductor.
- The 12 kV Vargas Circuit was inspected on October 19, 2010, and patrolled on May 4, 2010, with no problems reported on poles numbered 1511596E and 2198978E.
- On January 18, 2011, SCE tested the circuit breaker for the 12 kV Vargas Circuit and found it to be in good condition.
- A weather station at California State University San Bernardino located approximately 2.5 miles away from the Acacia Avenue incident site recorded the maximum wind speed and gust on January 14, 2011, at the time of the incident, to be 50 mph and 55 mph, respectively.
- Historic weather data for the general area where the incident occurred shows

that the wind speed and gust that were recorded by the weather station at the time of the incident were common for this area

Figure 2, titled *Overview of Scene*, shows the relationship of the poles to the house and the location of the conductors.

[REDACTED]

Figure 2
Overview of Scene

SCE Expert Opinions on the Cause of the Incident:
Dr. Gary Fowler (SCE's metallurgical consultant) visually examined the C phase conductor involved in the Acacia Avenue incident and found no evidence of mechanical breaking or tensile overload at the point of failure. However, he found evidence of arcing damage on the B phase conductor where the incident occurred as a result of the contact or near contact with the C phase conductor.

Dr. Carlos Fernandez-Pello, an SCE consultant, believed that there was a "causal connection" between the West Hill Drive event and the Acacia Avenue event. Dr. Pello opined that wind conditions, weight of the conductor, sagging of the conductor, and the electromagnetic force caused by the fault at West Hill Drive incident were factors that contributed to the movement of the B and C phase conductors at the Acacia Avenue site causing them to come in contact, or near contact, with each other.

Dr. T. C. Cheng, an SCE consultant, believed that the B phase and the C phase conductors arcing at the West Hill Drive site exposed the 12 kV Vargas Circuit to high current for a number of seconds resulting in electromagnetic force. This force, along with wind turbulence, contributed to the movement of the overhead conductors at the Acacia Avenue site causing the conductor to gallop (vertical and horizontal movement of conductor) and resulted in the B phase and the C phase conductors coming into contact, or near contact, with each other.

General Order 95 and Public Utilities Code § 451:

General Order 95, Table 2, Case 17-F, requires 6 inches of radial separation between conductors of the same circuit that are supported on the same pole. General Order 95, Rule 38 modifies the clearance requirements specified in Table 2.

General Order 95, Rule 38, Minimum Clearances of Wires from Other Wires, states:

> *"The minimum vertical, horizontal or radial clearances of wires from other wires shall not be less than the values given in Table 2 and are based on a temperature of 60° F. and no wind. Conductors may be deadended at the crossarm or have reduced clearances at points of transposition, and shall not be held in violation of Table 2, Cases 8–15, inclusive.*
>
> *"The clearances in Table 2 shall in no case be reduced more than 10 percent because of temperature and loading as specified in Rule 43 or because of a difference in size or design of the supporting pins, hardware or insulators. All clearances of less than 5 inches shall be applied between surfaces, and clearances of 5 inches or more shall be applied to the center lines of such items."*

SCE's 12 kV overhead conductors made contact, or near contact, with each other at two different locations and resulted in clearance reductions less than the 6 inches of separation required by General Order 95, Rule 38, Table 2. The 6 inch radial separation shall in no case be reduced more than 10 percent (0.6 inches) due to temperature and loading, as specified in GO 95, Rule 43. This would represent a clearance between the B and C phase conductors of no less than 5.4 inches.

The factors identified by SCE's experts as the cause of the overhead conductors' contact or near contact are known factors and not uncommon. SCE is required to take these factors in consideration when it designs and constructs electric facilities. SCE is in violation of GO 95, Rule 38, for failing to maintain the required clearance for its overhead conductors.

General Order 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*."

The failure that the 12 kV Vargas circuit experienced at Acacia Avenue and West Hill Drive was not a unique event but rather it was a common occurrence on the 12 kV

Vargas Circuit since at least 2006, when the circuit was created. SCE failed to take the necessary steps to prevent the recurrence of conductors failing due to contact or near contact, thus, SCE is in violation with GO 95, Rule 31.1, for not designing and maintaining its conductors in a way to prevent contact or near contact.

SCE's failure to take corrective action to redress recurring problems in its electric system is a violation of Public Utilities Code § 451. Section 451, which has been in effect since 1909 when California began regulating utilities, requires all public utilities to provide and maintain 'adequate, efficient, just, and reasonable' service and facilities as are necessary for the 'safety, health, comfort, and convenience' of its customers and the public:

> *"Every public utility shall furnish and maintain such adequate, efficient, just and reasonable service, instrumentalities, equipment and facilities…as are necessary to promote the safety, health, comfort, and convenience of its patrons, employees, and the public."*

General Order 95, Rule 51.6-A, High Voltage Marking of Poles, states:

> *"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. Such signs shall be of weather and corrosion–resisting material, solid or with letters cut out therefrom and clearly legible"*

Poles numbered 2198978E and 1511596E supporting the overhead conductors that failed had damaged "HIGH VOLTAGE" signs. This is a violation of General Order 95, Rule 51.6-A.

Figure 3, titled *Pole 2198978E*, shows the damaged "HIGH VOLTAGE", sign on the crossarm, evidence that SCE has been in violation of General Order 95, Rule 51.6-A.

Figure 3
Pole 2198978E

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

Law or Regulation	Section or Rule
Public Utilities Code	Section 451
General Order 95	Rule 31.1
General Order 95	Rule 38
General Order 95	Rule 51.6-A

Conclusion:

My investigation found that SCE is in violation of GO 95, Rule 38, for failing to maintain a 6 inch clearance between its overhead conductors at two different locations. My investigation also revealed that the 12 kV Vargas Circuit historically experienced similar conductor events, and SCE failed to take the necessary steps to prevent the recurrence of conductors contacting each other. The factors identified by SCE's experts are known factors that SCE is required to consider when it designs and constructs electric facilities. Therefore, SCE is in violation of General Order 95, Rule 31.1, for failing to design, construct, and maintain its overhead conductors to prevent them from contacting each other and failing. These factors contribute to my conclusion that SCE is in violation of Public Utilities Code § 451 for failing to take corrective actions to remedy Safety Hazards and failing to maintain a safe system. Finally, SCE is in violation of General Order 95, Rule 51.6-A, for having damaged high voltage signs on poles numbered 2198978E and 1511596E.

ATTACHMENT 2

California Public Utilities Commission
Consumer Protection and Safety Division

Investigation of Southern California Edison Company's Outages of November 30 and December 1, 2011

FINAL REPORT
January 11, 2013

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Executive Summary

On November 30, 2011 and December 1, 2011, powerful winds swept through Southern California Edison Company's (SCE) territory knocking down utility facilities, uprooting trees, and causing prolonged power outages. Two-hundred forty-eight wood poles and 1,064 overhead conductors were affected. The highest number of simultaneous customer outages was 226,053. Full restoration was completed at 6:21 AM on December 8, 2011. There were no reported injuries or deaths due to this incident.

The Consumer Protection and Safety Division (CPSD) of the California Public Utilities Commission's (CPUC) investigated the cause of the failed poles, SCE's restoration effort, and SCE's communication with the general public and governmental agencies during the incident.

CPSD determined that SCE and Communication Infrastructure Providers (CIP), who jointly own poles in SCE's service territory, violated General Order (GO) 95 safety factor requirements. The CIPs involved are AT&T, Champion Broadband, Charter Communications, Sunesys, Time Warner Cable, TW Telecom, and Verizon. At least 21[1] poles and 17 guy wires did not meet the safety factor requirements codified in GO 95, Rule 44.1. CPSD also found that SCE violated GO 95, Rules 17 and 19, for failing to adequately investigate the outages and pole failures and for failing to preserve the evidence.

CPSD found that SCE's restoration time was inadequate. In addition, information in SCE's emergency procedures was not updated and SCE personnel did not follow the training schedule outlined in its Local Public Affairs Plan. SCE did not ask for mutual assistance from other utilities.

[1] 20 poles that did not meet the safety factors requirements either failed or were damaged during the incident. One pole that did not meet the safety factor requirement was adjacent to some of the failed poles.

I. Introduction

On November 30, 2011 and December 1, 2011, powerful winds[2] caused damage to electric and communication facilities in SCE's service territory, resulting in prolonged power outages. The majority of the damage occurred in the San Gabriel Valley area. Two-hundred forty-eight SCE wood poles supporting electric and communications facilities and 1,064 SCE overhead conductors were damaged causing 440,168 customers to lose power. The highest number of simultaneous customer outages was 226,053. Power was not fully restored until December 8, 2011. There were no reports of injuries, deaths, or major fires due to the windstorm.

This report looks into the cause of the outages, SCE's communication with customers during and after the incident, SCE's restoration efforts and its preservation of evidence. Additionally, this report makes recommendations for improvements in SCE's system.

[2] Appendix A, Table A1, presents wind data that CPSD collected from stations located in and around San Gabriel Valley.

II. Outage Causes

Physical evidence necessary to determine the causes of facility failures during the incident was generally not available to CSPD at the time of its investigation, which CPSD initiated shortly after the incident[3]. SCE failed to preserve evidence and therefore violated evidence preservation requirements in GO 95 (see the Preservation of Evidence section of this report). Without access to crucial physical evidence, such as damaged poles, CPSD relied primarily on data obtained from SCE to analyze and make determinations related to outage causes and SCE's compliance with the Commission's safety and reliability regulations. Based on the information available, CPSD staff believes that having access to the physical evidence that was disposed of by SCE, would have significantly increased the likelihood of finding more instances where SCE failed to comply with GO 95 rules and where such noncompliance directly resulted in unnecessary damage to facilities and prolonged outages.

SCE's outage database shows that over 800 circuits experienced[4] outages during the incident. Table 1 shows the causes of the outages by circuit. A single outage may have multiple causes.

Table 1
Causes of Outages

Cause of Outage	Number of Circuits
Unknown	263
Other[5]	177
Vegetation	170
Conductor or Splice Failure	134
Pole Failure	79
Crossarm Failure	23
Conductor - Conductor Contact	13

The following sections examine the major outage causes in detail.

[3] An incident is defined as an event that involves electric facilities and results in either: death, in-patient hospitalization, media attention or $50,000 worth of damage.
[4] One circuit may have experienced more than one outage during the wind event.
[5] Other outages include outages caused by balloons, kites, cars hitting poles, animals, foreign utilities, and foreign objects in substations.

A. Pole Failure Caused Outages

Wood poles damaged during the incident were typically Douglas Fir and had various diameters and lengths. The poles supported a wide array of facilities, including distribution and transmission conductors, transformers, street lights, service drops, communication cables, span and down guys, and associated hardware.

The causes of pole failures during the incident fall into two categories:

1) Trees, tree branches or other objects falling into the poles. This is covered in section C.
2) The poles were not strong enough to withstand the force of the wind. This could have been the result of inadequate design and construction, overloading, weakening due to cracks and cavities, down guy failures, or low fiber strength.

GO 95, Rules 44.1 and 44.3 establish minimum safety factor requirements for electric and communication facilities. According to Rule 44.1, the safety factor requirements for wood poles at the time of construction range from 2.0 to 4.0 depending on the voltage of the electric facilities and the presence of other facilities supported by the pole. The safety factor is a measure that takes into consideration both the physical condition of the wood pole and the weight of the facilities attached to it. Rule 44.3 allows the safety factors to be reduced subsequent to installation to two-thirds or one-half of the original installation safety factor, depending on the pole's grade of construction.

Based on CPSD's request, SCE provided safety factor calculations for 248 failed wood poles. The calculated safety factors range from 1.3 to 26.34. The safety factors for 20 poles, representing 8.1% of all failed or damaged poles, were less than the values required by GO 95, Rule 44.3. The calculations for the 20 poles are attached to this report as Appendix B, Table B1. CPSD's investigation determined that an additional pole (pole number 1736753E), adjacent to other poles that failed also had a safety factor below the requirements of Rule 44.3.

GO 95, Rules 44.1 and 44.3 also establish minimum safety factor requirements for guy wires at the time of installation and subsequent to installation. The safety factors of 33 of the SCE guy wires attached to failed poles are provided in Appendix B, Table B2. CPSD's investigation determined that 17 guy wires had safety factors below the requirements of GO 95, Rule 44.3.

CPSD engineers, along with Arthur Peralta, an SCE wood products specialist, inspected pole segments that had been recovered by SCE and stored at SCE's Rio Hondo Substation. CSPD obtained Mr. Peralta's assessment on the loss of strength of 15 pole segments. Photographs of these 15 pole segments, along with Mr. Peralta's opinion, are shown below:

Pole Segment 1

Subterranean termite damage, with a significant loss of strength.


Figure 1


Figure 2

Pole Segment 2

Drywood termite damage, with a significant loss of strength.


Figure 3


Figure 4

Pole Segment 3

Small termite galleries near the center of the pole. Small loss of strength.


Figure 5


Figure 6

Pole Segment 4

Drywood termite damage, with virtually 100% loss of strength.

Figure 7

Figure 8

Pole Segment 5

Subterranean termite damage, with over 90% loss of strength.

Figure 9

Figure 10

Pole Segment 6

Drywood termite and woodpecker damage.

Figure 11

Figure 12

Pole Segment 7

Dry rot with virtually 100% loss of strength.

Figure 13

Figure 14

Figure 15

Figure 16

Pole Segment 8

Dry rot below groundline, with 80-90% loss of strength.

Figure 17


Figure 18


Figure 19


Figure 20


Figure 21


Figure 22

Pole Segment 9
Subterranean termite damage, with over 80% loss of strength.


Figure 23


Figure 24


Figure 25


Figure 26

Pole Segment 10
Drywood termite and woodpecker damage.


Figure 27

Pole Segment 11
Drywood termite and woodpecker damage.


Figure 28

Pole Segment 12
Drywood termite damage

Figure 29

Pole Segment 13
Termite damage, with minimal loss of strength.

Figure 30

Pole Segment 14
Fungal decay, with less than 10% loss of strength.

Figure 31

Pole Segment 15
Both fungal decay and termite damage.

Figure 32

Mr. Peralta provided an estimate of the percent loss of strength for the pole segments where damage was obvious through visual inspection. Mr. Peralta was not able to estimate the loss of strength for the pole segments where lengthier calculations was required (pole segments 3, 6, 10, 11, 12, 13, 15). CPSD reviewed Mr. Peralta's estimates and concurs with his opinion about damages. Mr. Peralta's opinion shows that at least 7 poles (pole segments 1, 2, 4, 5, 7, 8 and 9) had significant loss of strength that could have weakened the poles and caused them to fail. Reduction in pole strength causes a reduction in the pole's safety factor (e.g. a 20% reduction of pole strength corresponds to a 20% reduction in safety factor). These reductions could mean that there were more poles in violation of GO 95, Rule 44.3 then CPSD discovered.

B. Conductor and Splice Failure Caused Outages

During the incident, distribution conductors of various sizes and service drops failed resulting in outages.

The causes of conductor failures fall into the following categories:

1) Trees, tree branches or other objects falling into the poles. This is covered in section IIC of this report.
2) Conductors of different phases coming in contact with each other as a result of winds.
3) Pole failures. This is covered in section IIA of this report.
4) The conductors were inadequately sized, constructed or had deteriorated over time.

GO 95, Rules 44.1 and 44.3 establish safety factor requirements for conductors. The required safety factor is 2.0 at installation time and 1.33 subsequent to installation. Appendix B, Table B3 lists the installation-time safety factors for a number of the failed distribution conductors. The numbers are based on SCE's conductor sag charts. It should be noted that the safety factors are only applicable at the temperature indicated. Higher temperatures tend to increase the safety factor, while lower temperatures tend to decrease the safety factor.[6] The actual safety factors of the failed conductors prior to failure are unknown. However, several copper conductors that were removed from service by SCE showed signs of pitting and deformation indicating that their safety factors would have been lower than installation-time safety factors.[7]

C. Vegetation Caused Outages

Outage records indicate that vegetation was the cause of 170 circuit outages. The outages were caused by tree-pole contact, vegetation-line contact, trees falling into and breaking wires, and vegetation blown into a substation.

GO 95, Rule 35 "Vegetation Management" establishes clearance requirements between vegetation and power lines. Rule 35 also contains provisions related to the prevention of trees falling into power lines.

During the incident, a large number of trees and tree branches fell into and made contact with power lines causing outages. It is likely that, in certain instances, violations of Rule 35 existed prior to the incident and were directly related to the outages. However, CPSD cannot conclusively determine the exact configurations of the circuit/tree branch positions prior to the incident. As a result, CPSD cannot conclude that SCE or CIPs violated GO 95, Rule 35.

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[6] The higher the temperature the greater the sag will be on the conductor, which will cause the tension on the conductor to decrease. As the temperature decreases the sag will be decreased, which will cause the tension to increase.

[7] CPSD could not determine the conductors' location in the system because of the manner in which failed conductors were kept by SCE.

D. Unknown Outage Causes

SCE's outage records indicate "unknown cause" for a large number of outages. SCE Bulletin 322 outlines procedures for restoration work during high fire threat months in high fire threat areas. The number of sustained outages due to unknown causes increased because the bulletin requires that certain reclosers stay open when a fault is detected, instead of reclosing to see if the fault had self cleared. Reclosers that operated and are subject to SCE Bulletin 322, must be patrolled by SCE personnel for safety hazards prior to being reenergized.

Outage records obtained from SCE indicate that SCE staff visually examined numerous overhead circuits and found no cause and then re-energized the circuits. Possible causes for faults that self-cleared could be temporary conductor-to-conductor contacts or vegetation or other objects temporarily shorting the conductors.

III. Communication

CPSD investigated whether SCE provided timely and accurate outage information and support to residential and commercial customers, local governments and regulatory agencies. CPSD specifically looked into SCE's communication with medically sensitive customers, the public, and government.

A. Medically Sensitive Customers

SCE's Customer Communications Organization (including Customer Call Centers) and Consumer Affairs Department are responsible for the communication protocol and complaint resolution for medically sensitive customers. Edison System of Manuals 14.140.005, *Customer Notification Lists*, requires SCE to indentify medically sensitive customers[8]. Edison System of Manuals 14.140.015, *Services to Customers Requiring Life Sustaining Equipment*, contains procedures for communicating with the Medical Baseline customers (MBLs), as well as Critical Care customers, a subset of MBLs with less than two hours tolerance to loss of power.

As part of SCE's communication protocol, MBLs and Critical Care Customers can elect to receive Automatic Outage Communications (AOCs) and select a preferred method of contact, either through text messaging, text telephone (TTY), or email. Currently, these customers cannot receive notice by voice messaging, although SCE plans to add this feature in 2012. SCE periodically advises these customers of their options through annual mailings.

Prior to the incident, SCE had identified 397 Critical Care Customers in the affected areas. Of these, 55 had selected a preferred means of communication, and these 55 customers received outage information from SCE during the incident. An additional 107 of the 397 Critical Care Customers contacted SCE after the event began, and were assigned and received the automated callbacks available to all SCE customers. SCE's Consumer Affairs Manager, Linda Yamauchi, indicated that SCE received no notification of medical incidents during the outage, or complaints from dissatisfied, medically sensitive customers. Ms. Yamauchi believes these customers generally prepare better for power outages than typical customers due to their own efforts supported by SCE outreach programs.

Although SCE's policies and procedures do not require direct contact with medically sensitive customer in the field during power outages, SCE may elect to do so. SCE did not dispatch dedicated staff specifically tasked to contact MBLs or Critical Care Customers during the incident.

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[8] Medical sensitive customers include Medical Baseline customers as well as Critical Care customers. Medical Baseline customers are customers who require at least one medical life-support device in their home or who are paraplegic, hemiplegic, quadriplegic, multiple sclerosis, scleroderma patient, being treated for life-threatening illness, and/or has a compromised immune system. Critical Care customers are Medical Baseline customers that cannot survive with out electricity for more than two hours.

CPSD recommends that SCE follow through on its plan to add phone communications (voice messaging) to the menu of preferred contact options for medically sensitive customers. CPSD recommends that SCE expand its outreach to MBLs to improve upon the 13.8% of customers who had provided contact information prior to the wind event. CPSD recommends that SCE's Emergency Plan be revised to incorporate expanded contacts of MBLs during outage events.

B. General Public

SCE's primary means of communication with its customers during both emergencies and normal operations is through its Customer Call Centers. Customers call the centers to report problems such as outages or downed wires. Customer Service staff are available to assist customers in a variety of languages. Customers can also voice concerns and complaints to Customer Service Representatives (CSRs) and then escalate these complaints to the Consumer Affairs organization. In addition, some customers elect to receive automated outage information, including automatic outbound updates through SCE's Interactive Voice Response (IVR) system, or view outage information on the outage map at www.sce.com. SCE assigns a dedicated Account Executive to interface with its large business customers. Corporate Communications and Local Public Affairs provide information to the print and electronic media.

Customer Service Representatives, as well as the outage map and IVR system, receive outage information, including estimated restoration times, from SCE's centralized Outage Management System (OMS) database. SCE does not deploy a universal reverse-911 system to automatically locate and notify every affected customer in the geographical area of a major outage.

During normal operations, when a customer reports a "downed line" to SCE, a CSR enters the information into the Call Center's customer service system, which interfaces automatically with the OMS. The OMS identifies the location and makes the report visible to a District Operation Center (DOC). Under normal SCE policy, the DOC would typically immediately dispatch a "Troubleman" to the "downed line".

CPSD's investigation revealed that from November 30, 2011 to December 7, 2011, SCE received approximately 195,000 windstorm related calls, including approximately 4,000 reports of "downed lines". SCE received around 4,700 calls on an 800 number dedicated to "Essential Customers", which include public safety organizations and first responders. Due to the volume of calls, on December 1, SCE stopped responding to individual "downed lines", when it was known that the location was without power. SCE failed to properly communicate this fact to the public, leading to a perception that SCE was not responding to safety issues.

Ms. Yamauchi, stated that SCE opened seven centers to provide public information and distribute ice, water and flashlights. From December 3, 2001, to December 6, 2011, about 4,500 customers visited the distribution centers. On December 3, 2011, SCE dispatched 100 meter readers to wind-affected areas to contact customers, but these representatives spoke with only 750 people. SCE also used social media to update the public on power outages; SCE's Corporate Communication issued 281 Twitter "tweets", including twelve in Spanish, and SCE's Customer Service sent 141 tweets.

Inaccurate power restoration time estimates were a major issue during the incident. Lars Bergmann, Managing Director of SCE's Distribution Business Line, reported that early in the repair process, SCE field personnel estimated completion time based on fully evaluated circuit damage or actual work in progress, and SCE passed these estimates to the public through the OMS database. Mr. Bergmann reported that these predictions tended to be correct. However, Mr. Bergmann further explained that for less accessible repairs, he extrapolated from early or historical outage restoration experience to produce general estimates. Using these estimates for the windstorm proved overly optimistic, particularly for the more difficult or isolated repairs. Figure 1, titled, *SCE's Restoration Estimates*, shows the overly optimistic restoration projections.

The diagonal black arrows represent SCE's restoration estimates, and the pink curve represents the number of customers without power.

SCE's own report on its call center performance[9] found that the time of peak call call volume (December 1) customers waited on the telephones for over twenty minutes to speak with an SCE representative. During this period, approximately 2,000 customers abandoned their calls each hour. As a result, SCE is reviewing its call center staffing and procedures during emergencies.

Accurate, conservative estimates coupled with frequent communication empower customers to plan alternative accommodations and make adequate arrangements in the event of protracted outages. SCE should ensure it provides accurate estimated restoration time to its customers. In keeping with this goal, CPSD recommends that SCE analyze the accuracy of restoration time estimates during the incident and make changes accordingly. SCE should implement in-person "door-to-door" outreach activities during emergencies.

[9] Southern Californai Edison, *December 2011 Outage Report - Resonation and Communication Challenges and Root Cause Evaluation.*

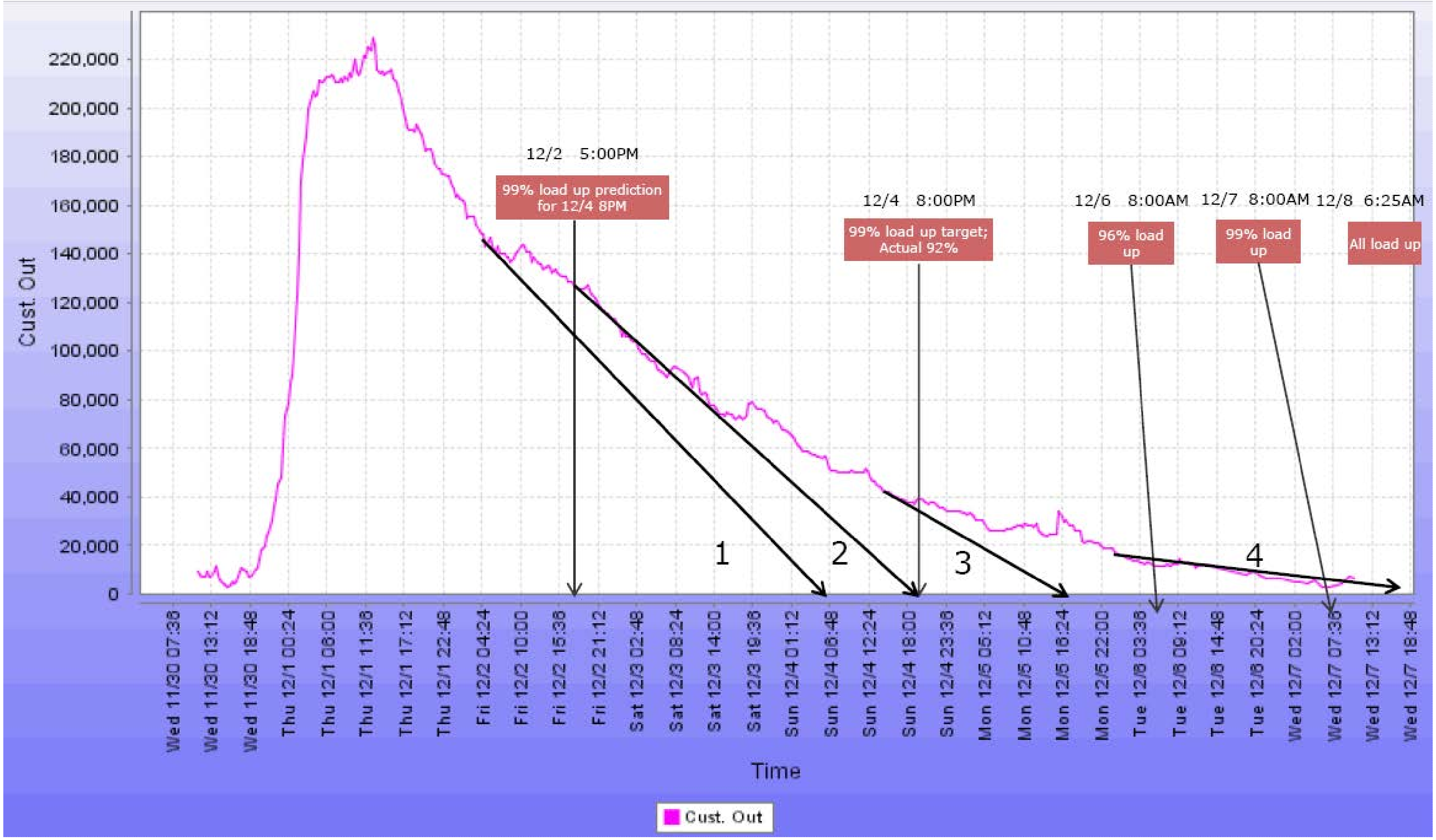

Figure 33
SCE's Restoration Estimates

C. Government

1. Regulatory Agencies

During normal and emergency operations, SCE's Claims department reports safety issues to CPSD as required by CPUC Resolution E-4184. During an emergency situation, SCE's Business Resiliency organization also reports significant outages to the CPUC, and to the California Utility Emergency Organization (CUEA) which in turn interfaces with the state's Office of Emergency Services (OES).

The CUEA typically oversees mutual assistance requests. SCE reported the outage to the CUEA, but did not request official mutual assistance through CUEA during this event (see the section later in this report on mutual assistance).

SCE submitted an incident report to the CPUC's designated email address on December 1, 2011. SCE also reported storm related damages through CPSD incident reporting system on December 1 and December 3, 2011.

SCE's 2011 Corporate Emergency Response and Recovery Plan (ERRP) contains outdated methods and points of contact for event reporting. Although SCE staff used the CPUC's web-based event reporting method, the ERRP emphasizes phone reporting, and does not include procedures for web reporting. The ERRP Appendices contain obsolete back-up CPUC contact numbers, in some cases phone numbers assigned to retired CPUC staff.

CPSD recommends that SCE review and update its emergency procedures at least annually to contain accurate contact information and reporting instructions.

2. Local Governments

SCE's Local Public Affairs (LPA) organization acts as a liaison with local community governments and safety personnel. LPA also serves as the primary SCE interface with county and city governments. Under a recent re-organization, LPA is part of the External Relations group, which also contains Corporate Communications. A primary responsibility of LPA is passing on official outage press releases developed by Corporate Communications. Corporate Communications also interfaces with the media.

LPA divides its responsibilities into six geographical regions, which contain multiple cities. A Regional Director oversees operations in each region, along with several Regional Managers (RMs). A RM typically manages four to eight cities or other governmental entities within a region. The RM is the primary point of contact with SCE during both normal and emergency operations for cities and counties.

GO 166, Standard 3 requires utilities to conduct an annual emergency exercise and provide notice of this exercise to appropriate state and local authorities, including the CPUC, Office of Emergency Services (OES), California Energy Commission (CEC), and emergency offices of counties in which SCE will perform the exercise. CPSD requested records showing that SCE made these required contacts. SCE produced records for the 2009 contact with the CPUC, but was unable to produce records for its November 2010 exercise.

In early 2011 LPA invited local governments to SCE's emergency response presentations. LPA also sent the communities information about SCE emergency processes for inclusion in the local governments' emergency plans. LPA requests to be invited to local government emergency training exercises. For example, LPA reports that during 2011, SCE personnel participated in training and tabletop exercises with the Los Angeles County Sanitation District and in the Beach Cities region. SCE also held a tabletop emergency exercise with Orange County.

To evaluate SCE's communication with local governments, CPSD spoke with public works, fire department, and city management staff from Arcadia, Irwindale, Monrovia, and Los Angeles County. CPSD also interviewed SCE's Director of Governmental Affairs for LPA, David Van Iderstine, about the operation of the Local Public Affairs organization. To solicit further public opinion, the CPUC held a hearing on January 26, 2012 in Temple City.

Mr. Van Iderstine explained that during the restoration, L.A. County Fire Department had frequent contact with SCE Fire Management, and that SCE stationed Fire Management personnel and LPA staff at the Santa Anita storm center. However, although SCE maintains a dedicated line for "Essential" customers including first responders, Arcadia fire department personnel had difficulty reporting and obtaining information about "downed lines". City of Arcadia Fire Department Battalion Chief Barry Spriggs reported that early during the outage, Arcadia safety personnel received the same responses as residential customers. Fire department dispatch would call SCE to report problems and SCE would place them on a list of "downed lines" reports. Battalion Chief Spriggs told CPSD that a few days later, SCE provided them with a direct cell phone number of a "Troubleman" to receive immediate response should more serious issues arise.

Scott Ochoa, Monrovia's City Manager during the windstorm, and Assistant Arcadia City Manager Jason Kruckeberg reported, and SCE's David Van Iderstine confirmed, that SCE's LPA liaison with these cities retired the day before the incident, and there was no permanent replacement in place. The officials reported that this may have contributed to the lack of information early in the outages. SCE assigned these responsibilities to a temporary replacement, and dispatched LPA personnel to storm service centers in Monrovia and at the Santa Anita racetrack across from Arcadia City Hall.

Mr. Kruckeberg reported that once located, SCE's LPA personnel were accessible and available, but lacked specific operational knowledge and authority. He explained that Arcadia staff were available to help in restoration, but were unable to coordinate with actual SCE operational personnel to determine if SCE could use such help.

Arcadia officials told CPSD that some of SCE's contractors seemed unfamiliar with the system. Battalion Chief Spriggs pointed out that in several instances customers reported energized power lines on the ground and that SCE told them their power was restored when it was still disconnected.   Mr. Bergmann of SCE indicated that SCE‘s focus during the windstorm was to safely restore power to primary conductors first. Once SCE energized the primary conductors, it polled smart meter data to locate all downed secondary lines and verify restoration of power to each individual customer. Therefore, SCE may have energized some down secondary conductors after restoring the primary conductors.

SCE based restoration information it provided to individual customers on the status of the primary circuit serving those customers. In some cases, SCE repowered the primary conductors without reconnecting the secondary to every customer on the circuit, which rendered this information inaccurate.

City government staff from Monrovia and Arcadia, as well as Gail Farber, Los Angeles County's Director of Public Works, expressed some frustration with restoration time estimates. JoEllen Chatham, LPA's Regional Director for the region which includes Arcadia and Temple City, told CPSD that a major complaint from the public and city officials was that SCE predicted 99% restoration by December 4, and failed to meet that goal. Los Angeles County's Ms. Farber opined that a better strategy would have been for SCE to immediately announce to the public that this could be a protracted event, and that customers should plan accordingly.

Not all comments from local governmental officials were negative. While not perfectly satisfied, Ms. Farber (L.A. County) and Mr. Ochoa (City of Monrovia) expressed general satisfaction, given the severity of the incident. Kwok Tam, Public Works Director for Irwindale, concurred with these sentiments. In Irwindale, a city with approximately 1,700 residents, SCE serves primarily industrial customers.

CPSD identified an inaccuracy in LPA's emergency planning document, the *2011 Emergency Response and Business Continuity Plan* (as provided to CPSD). In *Part 2: Plan Training, Testing and Maintenance*, the plan lists a number of training exercises the organization will hold over a three year period. SCE's LPA representative admitted to CPSD that this list is out of date and that LPA did not conduct all of these training exercises.

SCE failed to produce records showing emergency exercise notifications required under GO 166.

On February 7, 2012 CPSD staff interview San Marino Fire Chief Jim Frawley. Chief Frawley recommended the following emergency management improvements:

1. SCE should develop programs and train additional utility staff in Incident Command Structure (ICS), the National Incident Command System (NIMS) processes. At the time of the windstorm Mr. Frawley believes only about 20 SCE employees had received such this training.

2. SCE should develop incident management teams possibly using outside contractors, or at least staff with real disaster management experience
3. All utilities should coordinate emergency plans and have emergency plans reviewed by first responders.

City officials should have complete and accurate restoration time estimates to pass on to their constituents. Because CPSD located an error in LPA's training exercise schedule, which may indicate other errors, CPSD recommends that SCE review and update its emergency planning documents. Finally, SCE's LPA procedures should ensure a smooth transition when liaison personnel change.

CPSD also believes that SCE should carefully consider the recommendations of Fire Chief Frawley as it develops improvements to its emergency management planning and operations processes. In particular, California Assembly Bill 1650 ("AB1650"), approved on September 23, 2012, now requires public utilities to seek input from local first responders and to conduct regular training and emergency coordination exercises with community representatives in its service area.

IV. SCE's Restoration Efforts

CPSD reviewed SCE's restoration procedures and looked into its conformance with those procedures during the incident. Mr. Bergmann headed restoration efforts related to SCE's distribution system during the incident and was one of SCE's designated Storm Recovery Managers, along with the heads of SCE's Transmission and Distribution Business Unit's (TDBU) Grid Operations, Transmission, and Substation Groups.

Based on the information available, below is a timeline of SCE's escalation of the storm and restoration efforts.

Tuesday (November 29, 2011)

- Weather forecasts indicated stronger than expected winds. According to Mr. Bergmann, he received an internal SCE email on this date alerting him of the forecast.

Wednesday Morning (November 30, 2011)

- SCE participated in two conference calls and discussed the forecasted storm. One call, the Safety Performance Supervision Call, ran for approximately one and a half hours and involved TDBU distribution managers. The second call, a pre-storm conference call between multiple SCE business units, lasted approximately 30 minutes and involved a preliminary check on storm readiness.

Wednesday Afternoon (November 30, 2011)

- SCE released a press release notifying the public of possible high winds and provided them with safety tips.

Wednesday Evening (November 30, 2011)

- TDBU Grid Operations noticed outages on SCE's system. Between 7:00 PM and 9:00 PM, SCE opened storm management centers in approximately 5 districts. At 8:40 PM SCE declared a Category 2 Storm due to multiple regions being affected. At this point, approximately 14,000 customers were affected by the outage, but the numbers grew as the storm progressed. Storm management centers were primarily manned by district and regional managers who were observing the progress of the storm and planning for upcoming restoration work. Field work was limited due to high winds.

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Thursday Morning (December 1, 2011)

- The winds calmed down in the early morning. By 4:00 AM, approximately 200,000 customers were without power and 6 storm centers were opened. Supervisors from all districts cancelled approximately 50% of all planned work to free up crews for storm related work.

- SCE opened its Business Unit Storm Support (BUSS) at 9:30 AM to help with logistics.[10] [11] At this point, TDBU grid operations was unable to pinpoint damage due to the extent of the outages. SCE was relying on its approximately 4,000 downed line calls to dispatch restoration workers.

Thursday Afternoon/Evening (December 1, 2011)

- SCE switched from responding directly to downed line calls and adopted a procedure to restore circuits radially. At this point, SCE brought in contractors that it does not normally use (from outside geographical areas). SCE management estimated that approximately 18 of these crews were called in total over the course of the restoration efforts.

- By 10:00 PM, approximately 177,092 customers were out.

Friday Evening (December 2, 2011)

- Work progressed and storm centers were closed as SCE crews restored affected areas. SCE crews continued to move towards areas that still required storm related work. SCE downgraded the storm to Category 1 during this timeframe as affected regions were restored.

- By 10:30 PM, approximately 118,701 customers were out.

Saturday (December 3, 2011)

- SCE left districts that were restored or unaffected by the storm at skeleton crew levels. The last crews dispatched to work on storm restoration arrived at the remaining affected regions during this time. SCE continued to operate at these levels until restoration was complete.

- By 9:00 PM, approximately 76,526 customers were out.

[10] The time for when the BUSS was opened was obtained in an interview with Lars Bergman on January 13, 2012.

[11] SCE's internal report, "December 2011 Outage Report: Restoration and Communications Challenges and Root Cause Evaluation" claims the BUSS was activated approximately 12 hours earlier at 9:45 PM on November 30, 2011.

Sunday Through Wednesday (December 4 – Dec 7, 2011)

- SCE continued restoration efforts. Progression of restoration is as follows:
  - Sunday, 11:00 PM – approximately 36,000 out
  - Monday, 11:00 PM – approximately 16,519 out
  - Tuesday, 1:25 PM – approximately 7,924 out
  - Wednesday, 10:00 PM – approximately 543 out

- According to Mr. Bergmann, restoration efforts slowed down as time progressed because most remaining repairs only restored small pockets of customers.

Thursday (December 8, 2012)

- Restoration was completed by 6:21 AM and SCE began returning the labor force to regular duties.

Mr. Bergmann identified a number of general challenges associated with the windstorm including: 1) the unusual number of downed distribution conductors during the storm, 2) SCE's inexperience with dealing with this type of storm requiring a modification of their response methodology and 3) SCE's adoption of high fire threat procedures during its response.

During the wind storm, Mr. Bergmann indicated that there was an unusually high volume of calls. Per their usual practice, Mr. Bergmann and the other storm recovery managers initially focused their recovery efforts on repairing reported downed lines by dispatching crews directly to them. The Storm Recovery Managers found this method inefficient due to inaccurate information provided by callers. For example, an SCE crew may have responded to a downed conductor call only to find that a communication cable, and not a power conductor, had fallen.

According to Mr. Bergmann, after spending approximately half a day directly responding to the downed line calls, the Storm Recovery Managers decided to change SCE's restoration methodology. SCE de-emphasized its focus on downed lines because the Storm Recovery Managers believed that de-energized downed lines were not a major safety hazard. Instead, SCE chose to restore power starting from affected substations and restoring power to primary conductors before proceeding to repair damaged secondary conductors.

SCE's adoption of fire threat procedures during the incident may have also slowed down restoration efforts. Mr. Bergmann estimated that roughly 60% of the areas affected by the storm fell under Bulletin 322. November was listed as a high fire threat month, whereas December was not. However, Mr. Bergmann and the other Storm Recovery Managers decided to continue to carry on with Bulletin 322 procedures in December. They also decided to apply Bulletin 322 procedures to all lines affected by the incident. This meant that SCE personnel had to patrol all affected lines for problems before reenergizing them. Under conditions not subject to Bulletin 322, personnel had the option to energize a conductor to see if it held, eliminating a possible need for patrol. The additional patrols may have lengthened restoration times.

A. Mutual Assistance

GO 166 contains requirements covering the emergency preparedness of electric utilities to minimize damage and inconvenience to the public during an emergency.

GO 166 defines an Emergency or Disaster as an event which is the proximate cause of a major outage, including but not limited to storms, lightning strikes, fires, floods, hurricanes, volcanic activity, landslides, earthquakes, windstorms, tidal waves, terrorist attacks, riots, civil disobedience, wars, chemical spills, explosions, and airplane or train wrecks. GO 166 defines major outages as outages where 10% of a utility's serviceable customers experience a simultaneous, non-momentary interruption of service. A measured event is a major outage that affects between 10% (simultaneous) and 40% (cumulative) customers.

GO 166, Standard 1 requires that utilities prepare emergency response plans, which set forth anticipated responses to emergencies and major outages. GO 166, Standard 1H requires utilities to describe in their emergency response plan how they intend to employ resources available pursuant to mutual assistance agreements for emergency response reached with other utilities. Standard 1H states that "*mutual assistance shall be requested when local resources are inadequate to assure timely restoration of service or public safety. Mutual assistance need not be requested if it would not substantially improve restoration times or mitigate safety hazards.*"

SCE's outage records indicate that 226,053 customers out of a total of about 4.9 million customers, which amounts to approximately 4.6 percent of SCE's serviceable customers, were out of power. During the outage, about 440,168 customers in SCE's service territory experienced service interruptions, representing a cumulative outage percentage of 9.0%. Therefore, by the criteria set forth in GO 166, this incident was not considered a "major outage" and the requirements for the emergency plan, and consequently mutual assistance were not applicable.

SCE has defined specific thresholds and criteria, detailed in its Corporate Emergency Response and Recovery Plan as well as the TDBU Event Response and Recovery Protocol, which determine when SCE must evaluate the need for and request mutual assistance. TDBU's Event Response and Recovery Protocol identify three storm categories:

- Category 1 storms (Limited) involve localized geographic areas and limited activation of the storm organizations.

- Category 2 storms (Serious and Escalating) involve an escalating event, an expansion of affected geographical areas, or a large transmission related outage. During Category 2 storms, TDBU allocates more resources to storm organizations and may notify a designated Officer-In-Charge (OIC) of the event. The OIC is a designated SCE corporate officer on a rotating basis.

- Category 3 storms (Catastrophic) involve multiple regions. Restoration will likely exceed 72 hours. During Category 3 storms, TDBU storm organizations are fully staffed and can request mutual assistance.

The Event Response and Recovery Protocol states that "*the need for mutual assistance is evaluated based on the declaration of a Category 3 storm or by the specific direction of the T&D Storm Recovery Manager*." Although SCE did not escalate this particular incident beyond a Category 2 storm, SCE evaluated the need for mutual assistance at the direction of the Storm Recovery Manager. SCE also establishes a threshold for TDBU to request mutual assistance when all of the following conditions are met:

- A Category 3 storm is declared.
- Service restoration to SCE customers cannot be completed within 72 hours utilizing only SCE's available resources.
- The Storm Recovery Manager's opinion is that additional resources will significantly diminish restoration time.

These prevailing conditions were not met, and thus, SCE did not request mutual assistance. However, additional resources were called upon in the form of contractor labor.

Mr. Bergmann provided some insight into the decision making process in regard to evaluating and requesting mutual assistance.[12] Mr. Bergmann indicated that SCE favors the use of contractor labor over mutual assistance for several reasons which include the following:

- Contract workers, by the nature of their craft, have more general expertise of various types of circuits, equipment, and are familiar with SCE

[12] Interview of Lars Bergmann (Managing Director, Distribution Business Line, Power Delivery) conducted on January 5, 2012 at SCE headquarters in Rosemead, CA.

procedures due to prior experiences versus typical mutual assistance workers who are knowledgeable of the circuitry, equipment, and procedures of the particular utility they come from.

- Contract workers can be readily replaced if not performing satisfactorily, whereas mutual assistance workers are generally retained, regardless of performance, out of professional courtesy.
- Contractors generally have their own safety personnel, supervisors, and equipment while these things may need to be provided to mutual assistance workers which would further deplete available SCE resources.

While the circumstances of the incident did not prompt the requirement to enact mutual assistance agreements in accordance with GO 166 or SCE's internal policies, SCE identified a void in its available resources and decided the best way to fill that void was through the employment of contractor labor.

B. Emergency Plan

SCE refers to all events that require a significant level of increased resources as storms. Escalation of an event to a storm typically starts at a SCE business unit level. Generally, the storm is first classified by SCE's TDBU, which is responsible for the maintenance, construction and troubleshooting personnel that perform the majority of the field work on SCE's power system. TDBU also employs the personnel that monitor SCE's power grid.

When TDBU classifies a storm, it implements its Event Response and Recovery Protocol. This protocol creates centralized storm organizations to help manage the increased amount of work created by a storm. TDBU restoration work during normal operations is generally managed geographically at a district level. During storms, the storm organizations are able to create an inter-district expansion of work management to provide a multi-region strategic response to the storm. The storm organizations help reallocate and increase resources to affected areas, provide the logistical and engineering support for those resources, and provide additional work prioritization, tracking, and management functions.

When a Category 3 storm is in effect, TDBU notifies the OIC of the event, and the storm escalates to an emergency event, triggering the ERRP. This may involve the full mobilization of other SCE business units (e.g. Customer Support Business Unit) to help manage the storm.

When the ERRP is in effect, a corporate situation room and Emergency Operations Center (EOC) may also be activated to provide communication between corporate officers and the heads of individual operational business units.

The ERRP also contains procedures for reporting emergencies to government organizations such as the CPUC. GO 166, in part requires utilities to have emergency plans and to implement them when they experience "major outages" or "measured events".

During emergency events, SCE's Business Resiliency group is responsible for GO 166 reporting. According to an interview with Tom Jacobus, Manager of Business Resiliency, the storm did not meet the criteria as a major outage or measured event under GO 166. About 440,000 of SCE's approximately 4.9 million customers were affected by the storm. However, SCE reported the outage to the CPUC after an SCE's internal threshold of 30,000 affected customers was met.

During the windstorm, SCE did not escalate the storm above a Category 2. As a result, the ERRP was not fully triggered, and thus, SCE's situation room and emergency operations center were not activated. Mr. Bergmann did not feel that further escalation of the storm above Category 2 would have significantly reduced restoration times. According to Mr. Bergmann, an open EOC and the expansion of involvement from other SCE business units would not have significantly affected TDBU restoration operations.

C. Staffing Level

During storm events, SCE has a number of staffing options available:

a. Internal Staffing

Geographic Reallocation of Staff – During normal operations, SCE crews are assigned to specific geographic areas (districts) with limited movement between them. During a storm, SCE reallocates labor as needed to affected areas from outside districts.

Reassignment of Staff to Storm Duties – During a storm, SCE personnel may be assigned duties that they do not generally perform during day to day operations. Examples of this include the possible reassignment of troublemen, who normally perform damage assessment duties, into two-man crews that can perform minor repair and restoration work. Service planners and construction coordinators, who usually work on new construction, may be organized into Damage Assessment Teams to fill the damage assessment role vacated by the reassigned troublemen.

Mobilization of Support Staff – During storms, SCE can form a storm organization called BUSS. As field staff and repair work increase during storm conditions, logistical needs become more complex. The BUSS is created to relieve district managers, who generally handle these responsibilities, from logistics duties. The BUSS can also provide technical and engineering support to storm responders.

b. External Staffing

Contract Labor – SCE uses contract labor extensively during normal operations. During storms, SCE will generally tap into its contract labor pool as its primary means of expanding its labor force.

Mutual Assistance – SCE has agreements with other utilities that enable them to request additional labor.

According to Mr. Bergmann, SCE utilized all options above, except for mutual assistance, during the windstorm. SCE opened its BUSS, relocated labor geographically, and reassigned labor to storm restoration duties. SCE relied on contract labor to expand SCE's labor force. SCE estimated that approximately 80% of the contractors it used were from SCE's usual pool, while approximately 20% were from other areas, such as contractors working for other utilities.

Aside from the above staffing options, an integral aspect of effective and efficient restoration is the allocation of staffing resources. As described in the timeline, provided earlier in this section, on the morning of Thursday, December 1, 2011, SCE cancelled some planned work and diverted crews from non-affected districts. Conversely, Tables 3 and 4 below provide details on planned work that was not cancelled, but instead carried out simultaneously with restoration activities.

Table 2
Distribution Related Work Not Cancelled During Restoration Activities

Work Category	**Distribution Work Orders Issued**			
	December 1, 2011		*December 2, 2011*	
	SCE	*Contractors*	*SCE*	*Contractors*
Critical Maintenance	61	-	50	3
Capital Maintenance	50	3	41	8
Inspections	50	-	41	-
New Business	114	9	98	2
Routine Maintenance	78	3	55	4
Capital Projects	19	15	16	14
Totals	**372**	**30**	**301**	**31**

Table 3
Transmission Related Work Not Cancelled During Restoration Activities

Work Category	**Transmission Work Orders Issued**	
	December 1, 2011	*December 2, 2011*
Critical Inspections	39	9
Critical Maintenance	8	-
Capital Maintenance	88	70
Routine Inspections	28	48
Routine Maintenance	53	47
System Projects	10	45
Other	-	10
Totals	**226**	**229**

According to Mr. Bergmann, SCE personnel and contractors worked the majority of the storm in 24-hour shifts. As crews completed work and storm centers were closed, crews continued to move into other affected areas. SCE stated that it did not reduce labor until after restoration was complete on December 8, 2011.

Mr. Bergmann felt that during the storm, the work was balanced with the staffing levels. He said that, during the storm, work was not building up and crews did not have to rush to complete work.

CPSD found that, in practice, it is not clear how storm responders declare storm categories and what the appropriate responses to those categories are. For example, SCE's written criterion for a Category 3 storm is when "Service restoration cannot be completed within 72 hours utilizing available resources, due to the extent of damage to the transmission and/or distribution system". During the incident, outages lasted longer than 72 hours, yet a Category 3 storm was not declared. Another example involves SCE's Category 2 storm description which states that during a Category 2 storm, "All Storm Management Centers shall be activated". When the windstorm was in Category 2, not all Storm Management Centers were activated. CPSD recommends that SCE clarify the storm categories in its emergency plans and revise its procedures to remove the inconsistencies between how it defines its storm categories and how it uses them in practice.

V. Preservation of Evidence

GO 95, Rule 17 requires jurisdictional electric supply and communication utilities to develop investigative procedures to determine cause and minimize recurrence of "major accidents". Furthermore, GO 95 requires that all evidence collected as part of the utility's investigations be retained and made available upon request of the CPUC.

Due to high wind conditions at the outset of the incident on the evening of November 30, 2011, restoration efforts did not begin because of safety considerations associated with the high winds and safety of SCE crews. Restoration efforts began the following morning, December 1, 2011, when the wind conditions had sufficiently subsided. At the onset of restoration efforts, preservation of failed poles was not made a priority by SCE. This was made evident in a conversation with SCE staff where SCE staff indicated that the failed poles were not considered evidence.[13] Several days after the commencement of restoration efforts, upon further request the CPUC made its first request to SCE to preserve evidence on date at time from the CPUC, SCE began preserving failed poles.

The failed poles that were preserved by SCE were taken to SCE's Rio Hondo substation so that CPUC engineers could reconstruct the poles. These efforts were immensely hindered by the nature of SCE's collection and cataloguing methodology. Of the 248 poles that failed, partial segments of only roughly 60 poles were collected and delivered to the Rio Hondo substation for analysis by CPUC engineers.[14] The remaining poles were discarded by SCE staff. Of the poles provided by SCE, CPUC engineers were only able to completely reconstruct five failed poles. Factors impeding the reconstruction and assessment of these poles included the following:

- Poles were cut into segments, which in some cases were very small, such as 80 foot poles cut into 8-10 inch pieces (see Figures 1 and 2 below)
- Often times, segments belonging to one pole were scattered throughout various bins, increasing the difficulty and decreasing the likelihood of identifying matching segments
- Many poles had missing segments, making complete reconstruction of the failed pole impossible
- Pole segments, for the most part, were not catalogued in any discernible manner, making it nearly impossible to determine which failed pole they belonged to and exponentially increasing reconstruction time

The following figures provide a depiction of the conditions encountered by CPUC investigators at the Rio Hondo substation.

[13] Phone conversation between Raymond Fugere and Robert Ramos, SCE Claims Manager.

[14] Of all pole segments provided, only about 60 could be distinctly identified as belonging to unique poles, indicated by pole butts or the presence of ground lines

Figure 34
One pole cut into numerous small segments

Figure 35
Examples of small individual pole segments

Figure 36
Portion of pole segments at Rio Hondo substation

Figure 37
Small pole segments laid out for reconstruction at Rio Hondo substation

GO 95, Rule 17 identifies conditions that trigger utility initiated investigations of accidents, and reads as follows:

> *"Each owner or operator of supply lines shall establish procedures for the investigation of major accidents and failures for the purpose of determining the causes and minimizing the possibility of recurrence. Nothing in this rule is intended to extend, waive, or limit any claim of attorney client privilege and/or attorney work product privilege.*
> *Definition of major accidents and failures:*
> *(a) Incidents associated with utility facilities which cause property damage estimated at or about the time of the incident to be more than $50,000.*
> *(b) Incidents resulting from electrical contact which cause personal injury which require hospitalization overnight, or result in death."*

In response to a data request regarding SCE's investigation of this Incident pursuant to Rule 17, SCE provided the following on January 19, 2012:

> *"With respect to damage or destruction to SCE facilities as a result of the Nov. 30-Dec. 1, 2011 windstorm, we are looking into several possible contributing causes, including but not limited to extreme winds, downed trees or other flying material striking SCE overhead facilities,* ***loading of poles and support structures, internal wood deterioration*** *and various construction issues."*
> (Emphasis Added)

Although SCE specifically identifies "loading of poles" and "internal wood deterioration" as possible contributing causes being internally investigated pursuant to Rule 17, it failed to collect and preserve 248 damaged and replaced poles, as required by Rule 19. GO 95, Rule 19 stipulates that all evidence collected as part of utility investigations be retained and made available to the CPUC upon request. Specifically, Rule 19 states the following:

"Each utility shall provide full cooperation to Commission staff in an investigation into any major accident (as defined in Rule 17) or any reportable incident (as defined in CPUC Resolution E-4184), regardless of pending litigation or other investigations, including those which may be related to a Commission staff investigation. Once the scene of the incident has been made safe and service has been restored, each utility shall provide Commission staff upon request immediate access to:

- *Any factual or physical evidence under the utility or utility agent's physical control, custody, or possession related to the incident;*
- *The name and contact information of any known percipient witness;*
- *Any employee percipient witness under the utility's control;*
- *The name and contact information of any person or entity that has taken possession of any physical evidence removed from the site of the incident;*
- *Any and all documents under the utility's control that are related to the incident and are not subject to the attorney-client privilege or attorney work product doctrine.*

Any and all documents or evidence collected as part of the utility's own investigation related to the incident shall be preserved for at least five years. The Commission's statutory authorization under Cal. Pub. Util. Code §§ 313, 314, 314.5, 315, 581, 582, 584, 701, 702, 771, 1794, 1795, 8037 and 8056 to obtain information from utilities, which relate to the incidents described above, is delegated to Commission staff."

The facts and information detailed in this section demonstrate that there is sufficient evidence to conclude that SCE violated GO 95, Rule 19. Failed and replaced poles, which according to SCE's response are possible contributing causes to the damage and should have been included as evidence for SCE's own investigation, were discarded and could not be made available to the CPUC for inspection upon request. The exclusion of roughly 76 percent (approximately 188 of 248) of the failed and replaced poles from the Rio Hondo substation inspection site, where CPUC engineers analyzed pole damage caused by the incident, is a violation of the preservation of evidence clause specified in GO 95, Rule 19.

VI: Conclusion and Recommendations

The investigation found that the incident damaged and broke 248 poles. The safety factor for at least 21 poles and 17 guy wires did not meet the requirements of GO 95, Rule 44.3. In addition, SCE was did not preserve the evidence and investigate the pole failures.

Specifically, SCE was in violation of the following:

1. GO 95, Rule 19, for failing to preserve evidence.

2. GO 95, Rule 43.3, which requires electric utilities and CIPs to replace or reinforce their facilities before safety factors have been reduced to less than two-thirds of the construction safety factors specified in Rule 44.1. At least 20 poles that failed had safety factors less than two-thirds of the construction safety factors. In addition, at least 17 guy wires had safety factors less than two-thirds of the construction safety factors specified in Rule 44.1.

CIPs with facilities on the poles also failed to maintain their facilities in compliance with GO 95 requirements. The CIPs were in violation of GO 95, Rule 43.3, which requires electric utilities and CIPs to replace or reinforce their facilities before safety factors have been reduced to less than two-thirds of the construction safety factors specified in Rule 44.1. At least 18 of the 20 poles that had safety factors less than two-thirds of the construction safety factors were joint-used poles.

In addition to the above noted violations, CPSD concludes that:

1. SCE's emergency procedures are not clear about how storm responders declare storm categories and what the appropriate responses to those categories are.
2. SCE's emergency procedures were not kept up to date.
3. SCE personnel did not follow the training schedule outlined in its Local Public Affairs Plan.
4. SCE's restoration time was inadequate.

CPSD recommends that:

1. SCE update its emergency procedures to contain accurate contact information and reporting instruction.
2. SCE review and follow its training schedule.
3. SCE revise its storm categorization to expedite restoration.
4. SCE review its mutual assistance policy and determine if such assistance could expedite restoration level during major events such as this incident.
5. SCE's emergency procedures and mutual assistance plan should be tested annually with a full scale exercise.
6. CPSD should review and recommend modifications to General Order 166 where necessary to ensure that utilities are prepared to handle and respond to events of this nature.

Appendix A: Wind Data

Table A1
San Gabriel Valley Wind Data

Wind Station ID	November 30, 2011			December 1, 2011		
	Wind Speed (mph)	Wind Gust (mph)	Time	Wind Speed (mph)	Wind Gust (mph)	Time
DGRC1, Mt. Washington	24	85	11:58 PM	18	101	1:58 AM
DW5989, South Pasadena	10	23	11:20 PM	No data	No data	No data
DW4916, Pasadena	22	42	11:51 PM	22	47	1:46 AM
HNGC1, Henninger Flats	101	NA	10:58 PM	67	150	3:58 AM
DW3632, Sierra Madre	5	33	9:23 PM	No data	No data	No data
DW3624, Sierra Madre	12	NA	10:54 PM	No data	No data	No data
CW9396, Monrovia	9	21	11:27 PM	No data	No data	No data
KEMT, El Monte	9	NA	10:47 PM	12	NA	1:49 AM
STFC1, Sante Fe Dam	1	65	6:57 AM	33	68	2:57 AM
AR181, Duarte	14	26	23:23 PM	16	30	12:44 AM
CW8508, Duarte	8	30	11:25 PM	12	41	2:15 AM

Appendix B: Safety Factor Tables

Table B1
Safety Factors of Poles

Pole Number	Safety Factor	Safety Factor Required By Rule 44.3
1531855E	1.30	2.67
1237353E	1.33	2.67
740456E	1.66	2.67
1736777E	1.97	2.67
1531852E	2.17	2.67
1736781E	2.17	2.67
1736776E	2.19	2.67
4273079E	2.23	2.67
2121024E	2.28	2.67
4330720E	2.29	2.67
1736778E	2.31	2.67
1736779E	2.33	2.67
1736784E	2.34	2.67
1531846E	2.35	2.67
821521E	2.43	2.67
700710E	2.51	2.67
1736780E	2.51	2.67
1736782E	2.54	2.67
1736783E	2.63	2.67
1736785E	2.63	2.67

Table B2

Safety Factors of SCE Guy Wires

Pole No.	Guy Diameter	Attach Height	Lead Length	Tension Per Guy, no wind	Safety Factor (CPSD) at 25˚F and 8 lbs./ft^2 of wind pressure	Safety Factor SCE
1237354E	3/8	31.5	24	7494	1.840	3.075
1736777E	1/4	27	21	4887	**1.260**	0.97
1736777E	1/4	28	21	5000	**1.234**	0.95
1237353E	1/4	24	24	1390	3.737	3.42
821521E	1/4	25	28	5073	**1.218**	1.410
821521E	3/8	42	28	1825	5.706	12.660
821521E	5/16	20	27	4709	2.106	2.550
821521E	5/16	24	27	5063	1.975	2.370
663295E	1/4	21.5	21	3245	1.830	1.460
663295E	9/32	34.5	21	4000	1.992	2.240
736566E	1/4	21	14	3726	1.616	1.270
736566E	1/4	20	14	3604	1.665	1.320
736566E	3/8	41.5	14	28209	**<1**	0.550
736566E	5/16	19	12	5743	1.764	1.390
736568E	7/16	24	30	2892	5.095	10.785
736568E	9/32	32.5	30	10811	**<1**	1.245
736567E	9/32	37.5	10	7915	**1.065**	1.695
4323669E	1/4	24	39	1144	4.336	4.150
4323669E	3/8	59	84	10049	1.41	1.530
4323669E	5/16	24	31	1992	4.307	4.020
4323669E	5/16	23	31	1213	6.152	6.600
4323669E	5/16	25.5	39	1164	6.325	6.870
4323669E	9/32	34	33	19810	**<1**	0.450
4330720E	1/4	25.5	18	10242	**<1**	0.460
1531849E	1/4	23	30	4773	**1.288**	1.000
1049346E	9/32	20	19	3112	2.483	2.880
1049346E	9/32	19	19	4445	1.813	2.010
1049346E	9/32	37.5	22	8672	**<1**	1.030
1049347E	3/8	33	20	8523	1.639	1.810
1049347E	9/32	33	20	8523	**<1**	1.050
2336067E	1/4	22	35	3782	1.594	1.260
2336067E	1/4	23	35	3831	1.576	1.240
2336067E	3/8	42	35	2482	4.587	6.200

Note that all guy wires are composed of Extra High Strength (EHS) steel. The minimum required safety factor is 1.33.

Table B3

Conductor Safety Factors At The Time Of Installation.

Conductor size	Conductor type	Span length	Safety Factor at 25˚F and 8 lbs./ft^2 of wind pressure
336	ACSR	125	3.27
336	ACSR	200	3.12
336	ACSR	3000	*3.22
1/0	ACSR	105	4.48
1/0	ACSR	150	4.22
1/0	ACSR	155	4.20
1/0	ACSR	192	4.06
1/0	ACSR	200	4.02
1/0	ACSR	243	3.93
1/0	ACSR	300	3.87
No. 2	ACSR	500	3.39
No. 4	ACSR	30	*6.22
No. 4	ACSR	100	4.48
No. 4	ACSR	125	4.42
No. 4	ACSR	150	4.23
No. 4	ACSR	180	4.00
No. 4	ACSR	200	3.92
No. 4	ACSR	209	3.90
No. 4	ACSR	250	3.73
No. 4	ACSR	300	3.59
No. 4	ACSR	430	3.24
No. 4	ACSR	500	3.14
No. 4	ACSR	520	*3.09
No. 4	ACSR	600	*2.98
No. 4	ACSR	620	*2.96
No. 4	ACSR	800	*2.79
No. 4	ACSR	1250	*2.57
2/0	BARE COPPER	310	3.98
No. 4	COPPER	160	3.87
No. 4	COPPER	200	3.85
No. 4	SOLID COPPER	320	3.79
No. 4	SOLID HD BC	55	*4.66
No. 4	SOLID HD COPPER	158	3.93
No. 4	SOLID HD COPPER	166	3.91
No. 4	HD BARE COPPER	170	3.91
No. 4	SOLID HD COPPER	173	3.91
No. 4	SOLID HD COPPER	200	3.85
No. 4	SOLID HD COPPER	260	3.79
No. 4	HD COPPER	1000	*3.62
No. 6	COPPER	120	3.84
No. 6	COPPER	200	3.67
No. 6	COPPER	300	3.48
No. 6	COPPER	370	3.44
No. 6	HD COPPER	25	*5.75
No. 6	HD COPPER	100	4.31
No. 6	SOLID HD COPPER	130	3.91
No. 6	SOLID HD COPPER	140	3.83
No. 6	SOLID HD COPPER	150	3.82
No. 6	SOLID HD COPPER	160	3.73
No. 6	HD BARE COPPER	180	3.73
No. 6	HD COPPER	200	3.67
No. 6	HD BARE COPPER	250	3.58
No. 6	HD COPPER	321	3.49
No. 6	HD BARE COPPER	385	3.43
No. 6	HD BARE COPPER	500	3.36

Note that all copper conductors were assumed to be solid and medium hard-drawn. *As SCE's Sag-Temperature stringing table only applies to span lengths in between 100 feet and 500 feet, these safety factors were calculated using extrapolated sag values.

Appendix C: Applicable Rules, Regulations, and Definitions

GO 95, Rule 17, Investigation of Accidents states:

> *"Each owner or operator of supply lines shall establish procedures for the investigation of major accidents and failures for the purpose of determining the causes and minimizing the possibility of recurrence…*
> *Definition of major accidents and failures:*
> *(c) Incidents associated with utility facilities which cause property damage estimated at or about the time of the incident to be more than $50,000.*
> *(d) Incidents resulting from electrical contact which cause personal injury which require hospitalization overnight, or result in death."*

GO 95, Rule 19, Cooperation with Commission Staff; Preservation of Evidence Related to Incidents Applicability of Rules states:

> *"Each utility shall provide full cooperation to Commission staff in an investigation into any major accident (as defined in Rule 17) or any reportable incident (as defined in CPUC Resolution E-4184), regardless of pending litigation or other investigations, including those which may related to a Commission staff investigation… Any and all documents or evidence collected as part of the utility's own investigation related to the incident shall be preserved for at least five years."*

GO 95, Rule 44.3, Replacement states:

> *"Lines or parts thereof shall be replaced or reinforced before safety factors have been reduced (due to deterioration) in Grades "A" and "B" construction to less than two-thirds of the construction safety factors specified in Rule 44.1 and in Grades "C" and "F" construction to less than one-half of the construction safety factors specified in Rule 44.1. Poles in Grade "F" construction shall also conform to the requirements of Rule 81.3-A. In no case shall the application of this be held to permit the use of structures or any member of any structure with a safety factor less than one."*

ATTACHMENT 3

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Last updated on 14-MAR-2014 by: AMT
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