# California State Senate



COMMITTEE ON
ENERGY, UTILITIES AND COMMUNICATION
ALEX PADILLA, CHAIR

## SUBCOMMITTEE ON GAS AND ELECTRIC INFRASTRUCTURE SAFETY

JERRY HILL, CHAIR

# ELECTRIC GRID SAFETY: WHAT DO WE KNOW? HOW DO WE KNOW HOW WE ARE DOING?

The purpose of this hearing is to examine the state of understanding of electric grid safety. Though accidents are often reported in the media, accident statistics and performance measures among utilities is difficult to find and in large part do not exist apart from workplace accident reports mandated by the federal Occupational Safety and Health Administration (OSHA). These reports do not, however, cover injuries to the public. The lack of information may be addressed in part by harnessing information already reported to OSHA and to the Office of the State Fire Marshal, but may also call for greater electric safety performance monitoring by state and local agencies.

**A Bumpy Road to Risk-Informed Regulation of Electric Safety**

In 2006, Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas and Electric Company (SDG&E) petitioned the California Public Utilities Commission (CPUC) to eliminate one of their reporting requirements. Each utility had been required to report an electrical incident that caused a fatality, an injury resulting in overnight hospitalization, property damage of more than $20,000,[1] significant media attention, or vegetation fires. The last criterion had been added in 1998 after failed vegetation management programs had allegedly caused numerous wildfires. PG&E, for

[1] Since increased to a $50,000 threshold.

instance, had been convicted on 739 misdemeanor counts of criminal negligence for a fire in the Gold Country town of Rough and Ready.[2]

In 2006, however, PG&E, SCE, and SDG&E argued that small vegetation fires were of less concern than fatalities and serious injuries but constituted half of the reportable incidents, and that the serious fires would have been reported in one of the other categories. Additionally, the reporting was becoming a burden on the CPUC's safety division, whose policy had been (and continues to be) to investigate every incident reported to it. As such, the CPUC rescinded the reporting requirement for fire incidents.[3]

The following year, Southern California was devastated by a series of wildfires, several of the worst were caused by downed power lines.[4] In response, the CPUC adopted new power pole construction rules, maps for high fire threat zones in which new standards would apply, and—in a February 2014 decision—an annual reporting requirement for fires at least one meter in extent caused by utility equipment.

Unlike for natural gas, oil pipeline, rail, aviation, and highway safety, there is no federal regulator that has jurisdiction over the safety of the electric grid. Additionally, there is no federal body who investigates electric grid safety incidents. Without this federal coordination, there is no nationwide data on electric grid safety. This situation has placed California (and every other state) in the position where it needs to take on more responsibility if it is to ensure the same attention is paid to electric grid safety as to other modes of power and fuel distribution.

As the CPUC reports nearly 13 fatalities a year among investor-owned utility employees and the public connected to CPUC-regulated electric infrastructure, the subcommittee may wish to inquire as to whether the state has sufficient information to determine if enough is being done to prevent them.

**States' Responsibilities for Electric Safety Are Largely Unsupported Federally**

In the early 20th century, the federal government played a small role in transportation safety.[5] In 1967, however, Congress created the Department of Transportation, and the federal government began to assert safety jurisdiction and endow federal agencies with regulatory oversight of safety in automotive travel (National Traffic and Motor Vehicle Safety Act of 1966), in pipelines (Natural Gas Pipeline Safety Act of 1968 and, for hazardous liquids, Pipeline Safety Act of 1979), and in railroads (Federal Railroad Safety Act of 1970). At the same time, Congress created the National Transportation Safety Board (NTSB) to investigate aviation, highway, marine, pipeline, and railroad accidents and other accidents related to hazardous material transportation.

[2] http://www.sfgate.com/news/article/PG-E-Risked-Wildfires-Report-Says-2993459.php

[3] D.06-04-055, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/55906.PDF.

[4] "These included the Grass Valley Fire (1,247 acres), the Malibu Canyon Fire (4,521 acres), the Rice Fire (9,472 acres), the Sedgewick Fire (710 acres), and the Witch Fire (197,990 acres). The total area burned by these five power-line fires was more than 334 square miles." From CPUC Decision D.14-02-015, p. 3-4.

[5] Aircraft safety was the exception, and was federally regulated almost from the inception of air travel.

The Federal Energy Regulatory Commission (FERC) oversees interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas pricing, and oil pipeline rates. In response to the Northeast blackout in 2003—in which 50 million people lost power in the Midwest, Northeast, and Ontario—Congress passed the federal Energy Policy Act of 2005, requiring a FERC-certified electric reliability organization to develop and enforce reliability standards for the nation's transmission-level power system. The North American Reliability Corporation (NERC) has taken that mantle and developed standards for reliability, including for vegetation management, cybersecurity, and (pending FERC approval) physical security. Congress has not, however, given either FERC or NERC safety jurisdiction or authority of any kind over the states' distribution grids. For instance, the NERC vegetation management standards created after the Northeast blackout are required for transmission lines, not distribution lines.

After the September 2010 explosion and fire in San Bruno, the NTSB made a series of recommendations to the federal pipeline regulator (PHMSA), the CPUC, and to PG&E. As there is no federal electric safety regulator, and as NTSB does not investigate electric safety accidents, these substantial responsibilities—including that of an unbiased look at its own role in an accident—lie solely on 50 fragmented state commissions. This may explain why safety rules and regulations adopted by the electric industry and by states have not seen the evolution to performance-based regulation that the pipeline and transportation industries have seen. NTSB has, in particular, driven safety improvements in the industries whose accidents it investigates. For example:

- In 1998, NTSB recommended to the federal regulator that it determine the extent to which certain vintages of plastic pipe could be susceptible to a type of cracking that NTSB had determined to have caused 40 fatalities across the U.S. during the 1990's.[6] The federal regulator decided to forgo further regulation when industry developed the Plastic Pipeline Database Committee to collect and analyze failures of plastic pipe.[7] Plastic pipe failures in Cupertino and Roseville in the second half of 2011 led PG&E to analyze the failure rates of pipe identified by NTSB and prioritize it for replacement based on risk in advance of its 2014 General Rate Case Filing.

- NTSB has on several occasions recommended improvement in the specifications of DOT-111 rail tanker cars carrying ethanol and crude oil.[8] In response, the rail industry had revised its tank car standards even before the July 2013 derailment that killed 47 in Lac-Mégantic, Canada. Work by industry toward tank car standards, urged by NTSB, facilitated the U.S. Secretary of Transportation's proposal for a two-year phase-out of all tank cars that did not meet the new standard.[9]

The National Electric Safety Code (NESC), published by the Institute of Electric and Electronics Engineers (IEEE), is a construction and maintenance standard for electric transmission and distribution facilities.

[6] https://www.ntsb.gov/doclib/reports/1998/SIR9801.pdf
[7] http://www.apga.org/i4a/headlines/headlinedetails.cfm?id=295
[8] http://www.ntsb.gov/doclib/recletters/2014/R-14-004-006.pdf
[9] http://www.sacbee.com/2014/07/23/6578212/feds-propose-phasing-out-older.html

Most states incorporate NESC by reference into the regulations that govern electrical utilities. The CPUC is the exception, and has developed its own construction and maintenance standards in General Orders 95 (overhead lines) and 128 (underground facilities). California's publicly-owned utilities tend to follow the CPUC standards. Much like the American Society of Mechanical Engineers standard for pipeline construction and maintenance (ASME B31.8: *Gas Transmission and Distribution Piping Systems*), NESC and the CPUC's General Orders 95 and 128 are prescriptive standards and do not call on a utility to perform extensive data analysis or risk- or performance-based management of its system.

Electric incident data provided by the CPUC (table below) demonstrates some variation in injury and fatality rates among the three investor-owned utilities (data includes both worker and public injuries and fatalities). California's utilities (including publicly-owned utilities) and the CPUC recognize that variations in size, geography, and age of infrastructure make direct comparison of performance data between facilities a challenge.

**CPUC-Reportable Injury and Fatality Data, 2003-2014**

| | PG&E (5,359,808 customers) | | SCE (4,900,000 customers) | | SDG&E (1,379,247 customers) | |
|---|---|---|---|---|---|---|
| **Year** | **Injuries** | **Fatalities** | **Injuries** | **Fatalities** | **Injuries** | **Fatalities** |
| **2003** | 29 | 4 | 8 | 3 | 8 | 0 |
| **2004** | 24 | 4 | 14 | 5 | 5 | 3 |
| **2005** | 14 | 11 | 30 | 6 | 2 | 2 |
| **2006** | 9 | 5 | 29 | 11 | 2 | 3 |
| **2007** | 9 | 5 | 11 | 4 | 5 | 4 |
| **2008** | 12 | 5 | 25 | 3 | 5 | 2 |
| **2009** | 9 | 4 | 21 | 4 | 2 | 1 |
| **2010** | 6 | 7 | 16 | 4 | 0 | 0 |
| **2011** | 11 | 4 | 16 | 8 | 3 | 0 |
| **2012** | 13 | 4 | 18 | 7 | 6 | 3 |
| **2013** | 10 | 6 | 16 | 6 | 3 | 2 |
| **2014** | 7 | 2 | 13 | 7 | 2 | 1 |
| **Total** | 153 | 61 | 217 | 68 | 43 | 21 |
| **Average (no 2014)** | 13.27 | 5.36 | 18.55 | 5.55 | 3.73 | 1.82 |
| **Avg per million customer accounts** | 2.48 | 1.00 | 3.78 | 1.13 | 2.70 | 1.32 |

This variability was and continues to be the pipeline industry's argument for performance standards—that prescriptive standards cannot capture the variation of circumstances among utilities but must be supplemented with performance-based approaches that incorporate risk factors specific to each utility. For gas pipeline safety, this has been accomplished by the use of supplemental risk-based standards such as ASME B31.8S (*Managing System Integrity of Gas Pipelines*). The CPUC is currently considering requiring natural gas pipeline owners to annually report their performance along the 32 measures listed in ASME B31.8S.

As NESC does not include performance measures, states have had to develop their own. California's concerns with wildfires have motivated its emphasis on a risk-based approach to minimize electrical contact with vegetation in high-fire risk areas. After the widespread outages following Hurricane Sandy and investigations that found that the state's utilities power restoration efforts to be lacking, New York's Public Service Commission has developed a scorecard to compare its 6 investor-owned electric utilities

on their preparation for, response to, and communication during major outages.[10] Florida requires reporting on storm hardening activities in advance of hurricane season.[11] The CPUC may wish to explore more extensive use of performance metrics, as was done for gas.

A survey of the electric safety programs of larger state commissions finds that most, like the CPUC, require the reporting of fatalities and serious injuries. Similarly, state commissions often conduct accident investigations, though unlike California, the commissions surveyed from other states do not investigate every incident reported to them, but only those most serious or suspected to be caused by a utility violation.

Adding to the difficulty of comparing performance information between states, other states do not tend to post accident statistics or yearly reports. Oregon's public utilities commission is one exception, releasing an Electric Contact Report every few years that outlines injuries by category (and produces trend lines as long as two decades), analyzes the results, and offers recommendations.[12] The CPUC had published annual reports on gas and electric safety from 1997 until 2009, after which staff was redirected to higher priority work.[13] These reports did not include information on municipal utilities, who do not report accident statistics involving public safety incidents. It is unclear whether there is communication and coordination among these publicly-owned utilities on public safety matters, the lack of which could risk further insulation from lessons learned in each other's territories.

The electric industry has made some efforts to coordinate performance data, but those efforts have generally been scattered and subject to non-disclosure agreements that prevent both the public and state regulators from examining the results.

**Safety-related Information Exists Outside the CPUC**

The CPUC has been shown through reports, audits, and public discussions[14] to have a chronic shortage of effective information technology solutions to its data management problems. Should the Governor and Legislature choose to address this need, one should expect that resolution will only take place over multiple budget cycles, as the need spans the breadth of CPUC operations.

Even under these limitations, CPUC staff already has available to it a number of valuable data sources.

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[10] http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=13-E-0140

[11] http://www.psc.state.fl.us/utilities/electricgas/eiproject/index.aspx

[12] http://www.puc.state.or.us/safety/10contac.pdf.

[13] Subcommittee hearing, November 18, 2013. http://sd13.senate.ca.gov/multimedia/2013-11-19-senate-subcommittee-hearing-safety-and-california-public-utilities-commissio-0 (minute 02:02:40)

[14] During the November 14, 2013 CPUC Business Meeting, Commissioner Ferron half-jokingly proposed the CPUC sponsor a "hackathon" to address its transportation licensing backlog. During the November 18th subcommittee hearing, Commissioner Florio commented that the CPUC was in the process of developing a management system for CPUC orders but that "It's amazing how a little thing like [not having] a programmer can get in the way of an initiative."

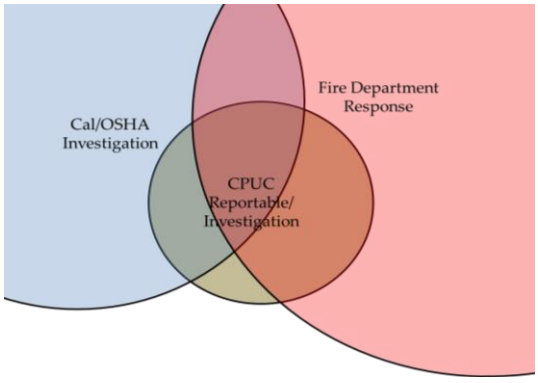
Despite the relatively small amount of electric safety information available from electric industry groups and regulators, safety-related incidents often involve other state agencies who have made significant investments in data collection.

The Department of Industrial Relations' Division of Occupational Safety and Health of the (commonly known as Cal/OSHA) investigates accidents and complaints, performs outreach to high-hazard industries, and oversees the public safety of select facilities such as elevators, amusement rides, and ski lifts. Cal/OSHA is the state partner to the federal Occupational Safety and Health Administration (OSHA). Labor Code 6313 directs Cal/OSHA to investigate all non-vehicular occupational fatalities and serious injuries or illnesses. In the case of fatalities, Cal/OSHA sends the next of kin a sympathy letter informing him or her of the opening of an investigation as well as a letter indicating the investigation's completion. In its partnership with OSHA, Cal/OSHA submits standardized accident and complaint data related to worker safety and health to OSHA, which is available—along with that from the other 49 states—on OSHA's website.

The Office of the State Fire Marshal (OSFM) within the Department of Forestry and Fire Protection (CAL FIRE) enters incident reports from most of the more than 900 fire departments in the state into a database compatible with the National Fire Information Reporting System (NFIRS), a joint venture between the Federal Emergency Management Agency, the U.S. Fire Administration, and the Department of Homeland Security. Given the potential for variations in data quality and reporting styles of the roughly 30,000 fire departments in the United States, NFIRS uses a detailed standard form in order to get statistically meaningful data.

OSFM has been collecting data electronically since the early 1980's, well before the start of NFIRS. While the reports submitted to OSFM have changed with the changing technology, and there exists some discontinuity in comparing fire data from different decades, the program is mature, with over 2.5 million incidents reported to the system annually. A search of downed electrical line incidents reveals that California fire departments responded to 6748 downed lines in 2012. Additionally, in 368 instances the probable cause for a fire was found to be a downed line. Utilities may track this information for their own systems as well.

Available Electric Safety-Related State Data



In addition to information in state databases, media reports can provide a starting point for asking questions about safety. A citizen group called The Utility Project has compiled news stories on electric outages and incidents in Northern California, including 28 reports of underground vault explosions and fires in San Francisco from 2005-2012, or almost four a year. Vault explosions can be dangerous as manhole covers of more than 100 pounds are often ejected, and in 2005 one hit and seriously injured Lisa Nash of Redwood City, burning over half of her body, as she walked to her San Francisco office.

Media reports may also capture incidents that may not be collected by any public agency. In April, a dog walking in Oakland was shocked after stepping on a PG&E grate, but was expected to recover. A dog walking over a grate in a Los Angeles park in 2013, however, was not so lucky. Dogs do not wear shoes, but the hazard is just as great for children who may touch a charged metal panel with bare hands or feet.

**Selected Safety Issue: Downed Power Lines**

A review of CPUC investigation reports reveals a number of themes in electric accidents, including electrocution from attempted copper theft at utility facilities, contacts by agricultural workers tending to orchards, and falls by utility workers from electric poles.

One type of incident—contact with downed electrical lines—may be of unique concern as it is not an occupational hazard and thus more difficult to mitigate through education and good industrial hygiene.

Downed electrical lines can create particularly dangerous situations. Live wires can reach the ground if a tree falls on the line or an automobile crash takes down a utility pole, but often the cause is an electrical fault that causes too much current to run through the lines—current that causes excess heat in weak spots and can cause equipment failure. These faults can be caused by electrical lines coming in contact with each other during wind events, or by vegetation or (unlucky) birds or squirrels causing a connection between two lines. Regardless of the cause, a downed electrical line will remain energized if it sits on a sufficiently insulating surface, such as asphalt—particularly in dry situations. Downed power lines that remain energized have a much greater chance of causing wildfires.

Liberty Consulting, in its assessment of PG&E's 2014 general rate case application,[15] noted "PG&E's wires-down investigations show that, on average, multiple times daily, and thirty six percent of lines presently remain energized until the Troubleman arrives." As mentioned above, OSFM reports that California fire departments responded to 6748 downed lines in 2012.

A number of fatalities have occurred from downed lines in the past several years:

- January 14, 2011: Steven Vego, Sharon Vego, and her adult son Jonathon Cole were killed in the early morning when they came into contact with a downed power line in their San Bernardino

[15] https://www.pge.com/regulation/GRC2014-Ph-I/Rulings/CPUC/2013/GRC2014-Ph-I_Ruling_CPUC_20130517_276140Atch02_276142.pdf

backyard. The father was electrocuted when attempting to put out a fire caused by the downed line, and the mother and adult son were killed while attempting rescue.

- November 12, 2011: Joel Ramirez died trying to put out an early morning fire in his Whittier house that was caused by a downed line.
- April 20, 2012: Enrique Tello came into contact with a downed power line in front of his San Mateo home and was electrocuted.
- April 24, 2014: A pedestrian was killed in Fullerton when he came into contact with a downed line that was lying on the sidewalk.
- May 14, 2014: Three miles from the 2011 Whittier electrocution, 45-year-old Juan Nieves was killed when he came in contact with a downed line early morning in his backyard after going out to investigate a large boom that accompanied a blown transformer.

Utilities attempt to prevent these types of accidents in a number of ways, including through public service announcements.[16] Energized downed power lines have traditionally been difficult to detect from the substation, but the widespread use of advanced metering infrastructure may offer the possibility of using smart meters as distributed sensors to detect operational aberrations and improve utility response times. The power line that killed Enrique Tello of San Mateo was energized for 32 minutes before the power was shut off.[17] In 2005, a Santa Clara FD firefighter was electrocuted by a downed line responding to an early morning house fire. The utility had not been able to cut the power for more than 90 minutes after notification of the fire by Santa Clara FD.[18] If a smart meter can tell the utility that a residence is without power, a network of smart meters should be able to detect line breaks.

The subcommittee has discussed the consequences of excavators hitting natural gas pipelines while digging,[19] and gas, electric, telecommunication utilities are in discussions with contract excavators and other interested parties to find a solution to reduce the chances of serious injury when working around buried gas and electric infrastructure. As the frequency of fire department responses to downed lines is comparable to that of excavation hits to natural gas infrastructure, and as the number of fatalities caused by downed lines has in recent years been greater than that caused by excavation damage, the subcommittee might feel that this topic is similarly worth its attention.

**Prepared by: Tony Marino**

[16] For SCE's recent PSA, see https://www.youtube.com/watch?v=ZvazCzxZhVk.

[17] CPUC investigation report, February 28, 2014.

[18] CPUC investigation report, January 17, 2006.

[19] June 4, 2013 hearing.