CALIFORNIA PUBLIC UTILITIES COMMISSION
Safety and Enforcement Division
Gas Safety and Reliability Branch
Gas Engineering and Compliance Section

Incident Investigation Report

Report Date: 11/16/2023

Incident Number: G 20221008-3443

Utility: Pacific Gas and Electric PG&E

Date and Time of the Incident: 10/8/2022, 9:15:00 PM

Location of the Incident: [redacted] River Plaza Dr. Sacramento, Sacramento
Sacramento ,CA
County: Sacramento

Summary of Incident:

On Saturday October 8, 2022 at 3:46 PM PG&E was notified of a fire at an 8-unit apartment building at [redacted] River Plaza Drive, Sacramento ("incident building"). A PG&E GSR arrived at 4:02 PM, was informed by the Sacramento Fire Department that an explosion has occurred. and measured gas in the soil near the riser to the incident building. PG&E's leak investigation found that a Plexco polyacetal service tee cap ("incident tee cap") that was installed in 1987 was cracked and leaking. Two juvenile males were in Unit 179 at the time of the explosion and reportedly received minor injuries. There were no fatalities.

PG&E Maintenance and Construction ("M&C") crews shut in the gas using a squeeze tool upstream of the leak at 8:50 PM. The plastic coupon was found to have partially dropped from the cutter. Exponent was retained to perform an investigation, which included site visits; retention, examination, and testing of evidence items; a records review; a review of codes and standards; and a review of PG&E's incident response.

The incident caused more than $50,000 of damage and was reported to CPUC and DOT. PG&E was notified of a fire at the incident house and dispatched a GSR, who arrived within 12 minutes. While on-scene the GSR measured gas in the soil above the service line and called for additional resources. A leak surveyor and an M&C crew responded, identified the source of the leak, and excavated and stopped the leak. PG&E used a squeeze tool upstream of the leak to shut off the flow of gas prior

to excavating the soil surrounding the leak. This minimized gas leakage and minimized the risk of ignition during excavation.

Casualties: ***Fatalities:*** 0 ***Injuries:*** 2

Property Damage: $216,874.00

Utility Facilities involved:

Pipe Material = Plastic, Pipe Size = 1 (inches), MAOP = 60 (psi), Operating Pressure = 54 (psi)

Witnesses:

	Name	*Title*	*Phone*
1	James Zhang	CPUC Investigator	N/A
2	[redacted]	PG&E Foreman /PG&E Sacr	
3	[redacted]	PG&E Gas M&C Supervisor/	
4	[redacted]	Exponent Inc	

Evidence:

	Source	*Description*
1	CPUC	Photographs of Incident Scene by JSN
2	PG&E	Incident Photos and Post Incident Photos
3	PG&E	Index 16125-04 leak survey_03_21
4	PG&E	Index 16125-05 leak surveys_10_09_22
5	PG&E	Preset data requests 2022 10 08 Sacramento
6	PG&E	PHMSA 7100.1 report
7	Exponent	Index 16125-02 Supp01_Exponent Report 2022

Observations and Findings:

On Saturday October 8, 2022 at 3:46 PM PG&E was notified of a fire an 8-unit apartment building at [redacted] River Plaza Drive, Sacramento ("incident building"). A PG&E GSR arrived at 4:02 PM, and observed emergency vehicles in the vicinity of the incident building. The GSR was informed by the Sacramento Fire Department that an explosion has occurred. The GSR proceeded to check for gas using a combustible gas indicator and measured gas in the soil near the riser to the incident building. Additional PG&E crews were dispatched to the site and a leak investigation was performed. The leak investigation found that a Plexco polyacetal service tee cap ("incident tee cap") that was installed in 1987 was cracked and leaking. The leaking cap was installed on the service line to [redacted] River Plaza Drive, which was across the road from the incident building. PG&E Maintenance and Construction ("M&C") crews responded and shut in the gas using a squeeze tool upstream of the leak at 8:50 PM. The plastic coupon in the incident tee was found to have partially dropped from the cutter. Exponent was retained to perform an investigation, which included: site examinations on 10/8/2022, 10/9/2022, and 11/4/2022; retention of evidence items; interviews with eyewitnesses, neighbors, and PG&E employees; pressure testing of gas piping components; laboratory testing of the incident cap; a review of codes and standards; and a review of PG&E's incident response.

Damage patterns observed in the incident building indicate that the highest overpressures were developed in the interstitial space between the first and second floors, which indicates that a significant volume of explosive gas and air mixture accumulated there. Following the explosion, a fire was ignited in Unit 179 on the first floor. Two juvenile males were in Unit 179 at the time of the explosion and reportedly received minor injuries. The two juvenile males did not report smelling gas but did report hearing a sound like a car door closing at the moment of the explosion. The ignition source of the explosion is undetermined, however the clothes dryer in Unit 179 was reported to be operating at the time of the explosion and cannot be ruled out.

Exponent performed laboratory testing of the incident tee and cap that included: pressure testing, optical microscopy, scanning electron microscopy (SEM), and fourier transform infrared spectroscopy (FTIR) to confirm the cap material to be polyacetal. During pressure testing at the approximate operating pressure at the time of the incident (55psig) several leak rates of air were measured: 200 SCFH was measured with the coupon removed, 90-130 SCFH were measured with the coupon in the approximate orientation that it was reportedly found after the incident, and 1.4 SCFH with the coupon inserted into the cutter, as would be expected at the time of installation and tapping of the main. The examination and testing of the cap indicated that the cap likely failed due to a long-term, slow crack growth mechanism, such as creep. Over time, the stresses imposed on the cap caused a crack to nucleate and grow until a through-wall rupture developed. The imposed stresses include applied stresses, installation stresses and possibly residual stresses. The testing did not identify any manufacturing defects that contributed to the crack initiation and growth. The precise material properties of the polyacetal

resin used in the original manufacture of the cap were not available. As such, a material quality defect cannot be ruled out, however Exponent did not observe any evidence to indicate a material quality defect. Exponent did not identify any likely installation defects, such as overtightening, as the incident cap showed no clear signs of a tool being used to tighten the incident tee cap.

The gas leak had likely existed for a number of weeks or months prior to the incident. The gas that leaked from the incident tee saturated the soil under large portions of the parking lot and saturated the soil on the south and east sides of the incident building, which was located 40’ north of the leak. Soil gas transport modeling performed by Exponent indicates that it would take approximately 3 weeks for an explosive gas mixture to accumulate in the soil adjacent to the incident building. The duration of the leak is estimated to be longer than this, due to the fact that 100% gas was measured in the soil at the incident building foundation. Remediation of the soil using soil vapor extractors took 17 days. The most recent compliance leak survey of the incident location on March 25, 2021 (~19 months prior to the incident) did not find any graded leaks. It is unlikely that a significant leak existed at the incident tee at that time. The exact path(s) by which the gas entered the building is undetermined, however penetrations through the poured concrete slab foundation cannot be ruled out. Entry through the sewer lines is not likely to have occurred. Small amounts of gas (significantly below the lower flammability limit) were measured in the cleanout.

Following the incident and out of an abundance of caution, PG&E replaced a total of 24 vintage tee caps (including the incident tee cap) in the immediate vicinity of the Riverview Ranch apartment complex. This included all of the Plexco service tees that had been installed on the same job as the incident service tee. There were 29 service lines affected by this tee cap replacement, but five were branch services that are not expected to have a dedicated service tee. Of the 24 total tee caps that were replaced: seven were found to have dropped coupons and intact caps and were not leaking; two were found to have cracked caps, coupons in place, and previously unidentified Grade 1 leaks; the incident service tee had a cracked cap, partially dropped coupon, and significant leakage; one had an internal crack that was not visible from the outside but was identified via a CT scan; and thirteen had no cracks, the coupons were in place, and no leaks. The exemplar tee caps were examined and were found to have varying degrees of markings, possibly from installation with a tool. Some of the markings could not be identified, and are possibly from the removal process.

Responding crews reported not smelling gas during most of the leak investigation and excavation process. Compliance sniff test records from the closest test point show gas-in-air reads taken before and after the incident met company standards for odorization. Analysis of gas samples taken from risers in the incident neighborhood showed sufficient concentrations of both tert-butyl mercaptan (TBM) and tetrahydrothiophene (THT).

PG&E standards from the time of installation of the incident service tee, such as GS D-21 Fusion Joining of Polyethylene Pipe (Rev. 9,1987), and B-90.1 Plastic System Polyethylene Fitting (Rev. 9, 1987) do not address how much to tighten tee caps. Product literature from Plexco from the approximate time of installation of the incident tee indicates that the tee caps should be hand tightened during installation. It is not clear whether the PG&E construction crews at the time had access to this information. The current PG&E standard, TD-4170P-60 Polyethylene Hot Tapping (Tapping Tee) (Rev. 0, 2020) indicates "tighten cap by hand until it seals. DO NOT use a wrench or tools to tighten cap."The fusion weld between the service tee and the mainline pipe has a melt bead that extends the full distance around the tee, but has melt patterns that are consistent with hand application of the heating iron. This fusion would likely have met the PG&E standards at the time, but would not meet the current PG&E standards which require the use of a guide tool (hand application is not acceptable).

A 2007 PHMSA advisory bulletin (ADB-07-01) warned about Plexco polyacetal tee caps, specifically the poor performance histories relative to brittle-like cracking. In response, Performance Pipe issued a bulletin that asserted that the Celcon polyacetal plastic material has not been found to be a problem, but that overtightening with a wrench could cause caps to fail. Data from the Plastic Piping Data Collection Initiative (PPDC) shows that failures of Plexco tee caps are relatively high for caps installed between ~1984 and 1987, with a peak in 1985. Additionally, the data shows that the most common reported age of Plexco caps at the time of failure is 31-35 years. The incident tee cap was 35 years old. A GTI paper in 2009 investigated plastic pipe failures and included an analysis of 10 failed tee caps. The failed caps had circumferential cracks at the first thread that exhibited a similar visual appearance to the incident cap. Many of the caps exhibited wrench marks. The available literature discusses the tightening of tee caps as either hand tight or tool tightened (if wrench/tool marks are present). Exponent did not identify any existing literature that discusses acceptable torque values and the effect of tightening torque on service life.

PG&E’s response to the incident was generally consistent with their internal standards and procedures and industry best practices. The incident caused more than $50,000 of damage and was reported to CPUC and DOT. Appropriate resources were deployed. PG&E was notified of a fire at the incident house and dispatched a GSR, who arrived within 12 minutes. While on-scene the GSR measured gas in the soil above the service line and called for additional resources. A leak surveyor and an M&C crew responded, identified the source of the leak, and excavated and
stopped the leak. The shutdown plan was appropriate. A squeeze tool was used upstream of the leak to shut off the flow of gas prior to excavating the soil surrounding the leak. This minimized gas leakage and minimized the risk of ignition during excavation.

Preliminary Statement of Pertinent General Order, Public Utilities Code

Requirements, and/or Federal Requirements:

None

Conclusion:

SED has not found any violations at this point. However, SED shall review the Exponent report and reopen the incident if necessary.