



Troy A. Bauer
Pipeline Safety & Compliance Manager

555 W. Fifth Street, ML GTEOC
Los Angeles, CA 90013

Cell: 909-376-7208
Email: TBauer@socalgas.com

April 23, 2020

Mr. Terence Eng
Program Manager
Gas Safety and Reliability Branch
Safety and Enforcement Division
California Public Utilities Commission
505 Van Ness Ave, 2nd Floor
San Francisco, CA 94102

Dear Mr. Eng:

Attached are SoCalGas' written responses to the Safety and Enforcement Division's (SED) investigation for DOT #1192024 reportable incident that occurred on October 1, 2017. SED found SoCalGas responsible for the following factors leading to the rupture of Line 235 West:

1. SoCalGas failed to maintain adequate external cathodic protection;
2. SoCalGas failed to provide adequate coating during construction;
3. SoCalGas failed to have a procedure for investigating transmission leaks; and
4. SoCalGas failed to control the pressure.

Please contact Troy A. Bauer at (909) 376-7208 if you have any questions or need additional information.

Sincerely,

A handwritten signature in blue ink, consisting of a series of loops and a long horizontal stroke that curves upwards at the end.

Troy A. Bauer
Pipeline Safety & Compliance Manager

CC:
Mahmoud Intably, SED
Kan-Wai Tong, SED
Claudia Almengor, SED

DOT Reportable Incident (#1192024) that occurred on October 1, 2017

1) General Order (GO) 112-F, Title 49 of Code of Federal Regulation (CFR), Part 192, §192.465(d) External Corrosion Control states in part:

“Each operator shall take prompt remedial action to correct any deficiencies indicated by the monitoring.”

SoCalGas failed to take prompt remedial action to maintain an adequate level of cathodic protection. SoCalGas commissioned the pipeline in 1959 with the cathodic protection (CP) system criteria in accordance to Part 192, Appendix D (1), which requires “a negative (cathodic) voltage of at least 0.85 volts”. The pipeline was requalified in 1994 with the cathodic protection system criteria in accordance to Part 192, Appendix D (3), which requires “a minimum negative (cathodic) polarization voltage of 100 millivolts.” SoCalGas failed to take prompt remedial action to address the deficiencies found during the operation and maintenance activities. See attached Table 1 showing dates and length of time of deficiencies. The longer an underground system remains without protection, the more the pipe will corrode compromising its integrity. Therefore, SoCalGas is in violation of §192.465(d).

TABLE 1

Test Station MP Start	Test Station MP End	Date First Identified	Calculated Days out-of-Tolerance	Actual CP Reading	Required CP
128.35	128.35	2/12/2005	769	0.3610	0.567
128.35	128.35	3/27/2010	712	0.3750	0.567
128.35	128.35	6/24/2013	674	0.4650	0.567
128.35	128.35	7/14/2015	1081	0.4460	0.567
128.73	128.73	2/12/2005	395	0.3890	0.470
128.73	128.73	3/27/2010	712	0.4210	0.470
129.06	129.06	3/27/2010	712	0.4508	0.529
130.62	130.62	2/12/2005	395	0.4450	0.481
130.62	130.62	3/23/2011	359	0.4750	0.481
130.62	130.62	7/25/2014	343	0.4200	0.481

SoCalGas Response:

SoCalGas acknowledges and understands the importance of safety, and accordingly the safety of our customers and the public, employees and contractors, and our system are foundational to our company. SoCalGas has taken several steps to reinstate cathodic protection and remain in tolerance with minimal CP downtime. SoCalGas has also taken additional steps to validate the integrity of Line 235, including two independent engineering studies, MOP reductions, and completion of targeted segment replacements on Line 235. The following are corrective actions taken by SoCalGas.

For the read points contained within Table 1¹, SoCalGas worked towards bringing the points within tolerance. Some of the read points required several rounds of remediation and other read points were attributed to remediation projects and constrained by the pipeline outage. Since then, SoCalGas has changed its remediation practice to avoid these types of constraints due to pipeline outages. The table and summary below provides additional detail.

Test Station Mile Post	Date First Identified	Status	Remediation
128.35	2/12/2005	Within Tolerance	Given the remote location of Line 235, the rectifiers are powered by natural gas directly from Line 235. While completing remediation (replacement/repairs) based on the In-Line-Inspection results for Line 235, the pipeline was removed from service, which caused the rectifiers to be down and, in turn, the read points to be down. Once the pipeline was returned to service along with adjustments to the Line-4000 connection, L-235 polarized above the minimum voltage criteria.
128.73	2/12/2005	Within Tolerance	
130.62	2/12/2005	Within Tolerance	
128.35	3/27/2010	Within Tolerance	The read points were down due to a CP Engine at MP 136.02 being out of service and electrical shorts at the Newberry Compressor Station. The CP engine was out of service for approximately 6 weeks while required mechanical repairs were completed. In parallel, troubleshooting at Newberry Compressor Station revealed that there were several electrically shorted locations that needed to be remediated. Once the CP engine was repaired and the electrical shorts were remediated at the Newberry Compressor Station, L-235 polarized above the minimum voltage criteria.
128.73	3/27/2010	Within Tolerance	
129.06	3/27/2010	Within Tolerance	
130.62	3/23/2011	Within Tolerance	
128.35	6/24/2013	Within Tolerance	Given the remote location of Line 235, the rectifiers are powered by natural gas directly from Line 235. While completing remediation (replacement/repairs) based on the In-Line-Inspection results for Line 235, the pipeline was removed from service, causing the rectifiers to be down and, in turn, the read points to be down. To mitigate the low read points during this time period, anode wells in the surrounding area were watered to try to increase current output and the rectifier at MP 124.26 was increased. Once the pipeline was returned to service, L-235 polarized above the minimum voltage criteria.
130.62	7/25/2014	Within Tolerance	
128.35	7/14/2015	Within Tolerance	Returning the read point to within tolerance was challenging and required continual action. This read point required drilling three replacement deep well anode beds at Line 235 MP 136.02, Line 235 MP 142.3, and Line 4000 MP 17.7. At the same time, rectifier outputs were increased, electrical shorts cleared at the Newberry Compressor Station, and an attempt was made to bond Line 4000 and Line 235 to direct additional current to this location. After the deep well anode replacements were completed, additional current was still required and an additional deep well anode bed on Line 235 at MP 128.18 was also needed. Once the additional deep well anode bed was completed, Line 235 polarized above the minimum voltage criteria.

¹ Table 1 was originally created as part of response to a SED Data Request (July 2018) and captures timelines relevant to that time period.

SoCalGas Corrective Actions:

Field Response Update

SoCalGas has further improved the Cathodic Protection (CP) systems on Line 235 by replacing targeted segments of pipeline totaling over 4 miles, between Newberry and Victorville. SoCalGas has been continuing its efforts to install new and replace existing CP systems, as well as provide additional CP system flexibility and manageability by electrically isolating areas.

There have been significant CP improvements to the incident location:

- SoCalGas installed 2,300 feet of Fusion Bonded Epoxy (FBE) coated pipe at the site.
- SoCalGas installed over 4,000 feet of linear anode for localized cathodic protection as an interim measure until a new cathodic protection rectifier is installed at the rupture location (MP 129.55).
- SoCalGas installed several new Electrical Test Stations (ETS) at the area for further CP monitoring and corrosion mitigation effectiveness.
- SoCalGas installed an in-line electrical isolator which effectively isolates the points listed in Table 1 into a 9-mile segment. This smaller segment has its own CP current sources, and additional current sources are being planned.
- In addition, SoCalGas installed a new cathodic protection rectifier on the 9-mile segment at mile post 128.18. This rectifier supports every read point on Table 1 and provides CP current to the entire segment

Construction Update

SoCalGas has also changed the way long-term pipeline projects are handled in the field in terms of Cathodic Protection. Given the remote location of Line 235, the rectifiers along the pipeline are powered by natural gas from the pipeline. Although this provides operational flexibility on where the rectifiers can be installed (which is important given limited electrical lines), it causes issues when the pipelines are removed from service. For long-term pipeline projects that will require the pipeline to be out of service, portable generators are installed temporarily to provide current to the rectifiers, which eliminates rectifiers being down during the repair time period. SoCalGas is also electrically bonding separated sections to ensure CP electrical continuity during construction. In addition, SoCalGas has increased the leak survey frequency of 100mV criteria lines by performing bimonthly aerial surveys as well as semi-annual ground instrument leak survey patrols.

Engineering Update

SoCalGas engaged two independent engineering firms to conduct studies of Line 235. The objective of the first study was to perform a corrosion reliability analysis of the pipeline. The result of this study led to a Maximum Operating Pressure reduction from 936 PSIG to 780 PSIG and targeted replacements at 6 locations.

In tandem, a second study was initiated to identify statistically active corrosion. The comprehensive study integrated in-line inspection results, historical pipe-to-soil reads,

impressed current outputs, bellhole examinations, and soil and precipitation data. The results have been used to supplement and expand the scope of repair locations.

Additionally, a Close Interval Survey on Line 235 from Newberry Springs Compressor station to Victorville was initiated in 2019 to coincide with the in-line inspection of Line 235. The survey included interrupted reads to obtain the polarized potential of the line. A planned depolarized survey of Line 235 has been delayed due to the COVID-19 pandemic. Once the depolarized survey is completed, SoCalGas will have a comprehensive representation of the polarization of the line at a granular level. SoCalGas has also worked with consultants to identify and prioritize locations along the pipeline for remedial actions including pipeline recoating and the installation of additional impressed current sources to increase the polarization on Line 235.

2) State of California Public Utilities Code §451 states in part:

“Every public utility shall furnish and maintain such adequate, efficient, just, and reasonable service, instrumentalities, equipment, and facilities, including telephone facilities, as defined in Section 54.1 of the Civil Code, as are necessary to promote the safety, health, comfort, and convenience of its patrons, employees, and the public.”

SoCalGas failed to adequately install and maintain coating during construction. Southern California Gas Company, Technical Root Cause Analysis of 30-Inch Diameter Pipeline 235 West Rupture (10/1/17), dated April 27, 2018, states in part:

“The first technical root cause identified for the October 1, 2017, failure is the use of native backfill during initial construction reduced the long-term effectiveness of the corrosion control system of Line 235 West (i.e. coating and cathodic protection)”.

The installation method and backfill material (soil condition-rocky material) at the time of the initial construction of Line 235 West contributed to the coating damage and degradation of the coating system. This caused a reduction in effectiveness of the external corrosion protection and resulted in gas leaks/rupture. SoCalGas failed to ensure that the furnished backfill material was adequate, free of rocks material or other substance that may cause damage to pipeline coating. This resulted in the reduction of effectiveness of the external corrosion protection. Therefore, SoCalGas is in violation of State of California Public Utilities Code §451.

SoCalGas Response:

SoCalGas acknowledges the soil condition surrounding the point of natural gas leak/rupture was rocky, and the surrounding soil likely damaged the coating over time as found in the Root Cause Analysis. However, there is no evidence demonstrating that the initial backfill did not meet the construction specifications. The construction specifications within the “Excavation” section required:

- *The padding in the entire length of the trench shall be graded and dressed so that the pipe will have a substantially continuous and uniform bedding.*
- *The padding in the entire length of the trench bottom shall consist of cushion at least 4” in depth, composed predominantly of fine material.*
- *A small proportion of coarse material may be included, but no material with a largest dimension of 2.5” or more will be permitted in the padding.*
- *The intent is that the cushion of padding will have a characteristic that will permit the depression of larger elements into the padding by the pipe without damage to the coating.*

The construction specifications then reiterated this point in the “Lowering” section:

- *Immediately before lowering the pipe into the trench, the trench bottom shall be cleared of all rocks in excess of 2.5” inches largest dimension and all foreign material.*

The original construction specifications provided requirements for an excavation that would not damage the coating. In addition, the Root Cause Analysis noted, “In addition, the coating degrades with time because of soil stresses, or movement of the pipe in the ground and other factors.² Degradation of the pipeline coating in service also can lead to disbonding from the pipe surface, further exposing metal to the underground environment.”³ Given that the pipeline was installed over 60 years ago, there are a number of factors that could have led to coating degradation. Consequently, it is far from conclusive that the degradation of the coating was solely attributable to the original construction activity as the soil conditions surrounding the pipeline may have resulted from over 60 years of underground movement and environmental impacts. In any event, the coating applied at the time of construction was consistent with industry practices during that time.

SoCalGas Corrective Actions:

Over the last 60 years, construction practices have continued to improve. The current Material Specification **26-10** “Utility Trench Backfill – Base and Shading Material” provides stringent requirements for the soil composition to be used during backfill activities. This requirement is referenced within the gas standard **223.0003** “General Construction Requirements - Steel Transmission System.”

3) GO 112-F, Reference Title 49 of CFR, Part 192, §192.605(a) Procedural maintenance for operations, maintenance, and emergencies states in part:

“General. Each operator shall prepare and follow for each pipeline, a manual of written procedures for conducting operations and maintenance activities and for emergency response. For transmission lines, the manual must also include

² Other factors that contribute to coating degradation over time include: absorption of water, attack by MIC, chemical degradation, cathodic disbondment.

³ DNV Root Cause Analysis, page 14

procedures for handling abnormal operations. This manual must be reviewed and updated by the operator at intervals not exceeding 15 months, but at least one each calendar year. This manual must be prepared before operations of a pipeline system commence.”

SoCalGas did not have a Gas Standard to address leakage investigation on a transmission line. Instead, SoCalGas used its Gas Standard 184.0245, Leakage investigation – Distribution to perform leakage investigation on transmission line 235 West. Therefore, SoCalGas is in violation of §192.605(a) for not having a leakage investigation procedure for transmission lines.

SoCalGas Response:

SoCalGas did in fact have a Gas Standard to address leakage investigation on a transmission line at the time of the incident. Gas Standard 184.0245, Underground Leak Investigation, was revised and expanded in 2013 to provide guidance on investigating above ground leaks in addition to underground leaks. During the publication process, the title was changed from “Underground Leak Investigation” to “Leak Investigation – Distribution,” which inadvertently omitted “and Transmission.” As evident by the policies and procedures in the Gas Standard, the requirements were still applicable to Transmission. In addition, the Gas Standard remained in the Transmission Operating and Maintenance tab Binder. The title of Gas Standard 184.0245, *Leak Investigation – Distribution* was revised on 06/28/2018 and "Distribution" was removed from the title. Gas Standard 184.0245, *Leak Investigation* applies to the Distribution, Transmission, and Storage operating groups.

4) GO 112-F, Reference Title 49 of CFR, Part 192, §192.615(a)(6) Emergency Plans states in part:

“Each operator shall establish written procedures to minimize the hazard resulting from gas pipeline emergency. At a minimum, the procedures must provide for the following:

...

(6) Emergency shutdown and pressure reduction in any section of the operator's pipeline system necessary to minimize hazards to life or property.”

On September 25, 2017, SoCalGas performed an aerial leakage survey where both Line 4000 and Line 235 are parallel (20 feet apart) and found a gas leak indication. On September 29, 2017, SoCalGas excavated a section of Line 4000 and did not find any gas leaks. SoCalGas shifted its attention to Line 235 West (parallel to Line 4000) and performed a leakage investigation using its Gas Standard 184.0245, Leakage investigation – Distribution. At this point, SoCalGas knew that the source of the gas leak was Line 235 West. While SoCalGas was investigating to determine the exact location of the gas leak, the pressure on Line 235 was increasing. This exacerbated the location of the gas leak and changed its behavior and resulted in a rupture of Line 235 West. See attached Table 2 for the dates and pressure readings. SoCalGas did not react to the gas leak situation or reduce the pressure on Line 235 West in a timely manner.

Instead, SoCalGas allowed the pressure on Line 235 to continue to increase until the pipeline ruptured. The failure of SoCalGas’ action to this hazardous circumstance compromised the safety of its employees, the general public, and the environment. SED found that none of the SoCalGas’ Gas Standards (applicable at the time of the incident) addressed the shutdown or pressure reduction requirement to prevent pipeline rupture caused by pressure increase after a gas leak indication on a transmission pipe. SoCalGas crew were exposed to the imminent danger at the time of the pipeline rupture. Therefore, SoCalGas is in violation of §192.615 (a) (6) for failing to establish and follow adequate written emergency response procedures.

TABLE 2

Date	Highest pressure	Lowest pressure
Sept 25, 2017	763.75 psig	707.44 psig
Sept 26, 2017	754.36 psig	711.72 psig
Sept 27, 2017	732.34 psig	670.26 psig
Sept 28, 2017	771.89 psig	712.69 psig
Sept 29, 2017	748.09 psig	706.36 psig
Sept 30, 2017	826.47 psig	729.98 psig
Oct 1, 2017	907.00 psig	717.64 psig

SoCalGas Response:

The day before the rupture, the leak was classified as a Code 2 Leak, “CODE 2 LEAK INDICATION – a leak that is recognized as being not hazardous at the time of detection, but justifies scheduled repair based on the potential for creating a future hazard,” per Gas Standard 223.0125. The leak was not identified as an immediate (emergency) repair condition that required immediate excavation; thus a reduction in operating pressure was not required at that time. The crew returned the next day to re-center the leak and confirm the location per Gas Standard 184.0245, which also did not require a pressure reduction. At no time was this leak indication found to be a hazardous situation prior to the crew recognizing the change in conditions, stopping the job and evacuating to a safe location.

Consistent with routine operations, the operating pressure on Line 235 West varied based on system requirements. The pressure at the time of the failure was 907 psig, which was under the maximum allowable operating pressure (MAOP) of 936 psig.

SoCalGas Corrective Actions:

SoCalGas recognizes that in an abundance of caution the pressure of a transmission pipeline can be reduced by 20% from the most recent operating pressure experienced, similar to immediate conditions, to provide a safety margin during the investigation of a leak regardless of its classification. SoCalGas has updated Gas Standard 184.0245, Leak Investigation to include a pressure reduction and specific procedures to address the potential for a pipeline within close proximity.