Cause Evaluation Report

☐ **Root Cause Evaluation (RCE)**

☒ **Apparent Cause Evaluation (ACE)**

☒ **Non-SIF** ☐ **SIF-Potential** ☐ **SIF-Actual**

☒ **PG&E Incident** ☐ **Contractor Incident**

Contractor: [N/A]

Report Rev: 01

☐ **DRAFT**

☐ **Approved by Sponsor, Cause Evaluator, TeamLead**

☐ **CARB Approved**

☒ **FINAL Approved Report**

This report has been thoroughly reviewed and is hereby approved by the following:			
Role	**Name, LAN ID**	**Title**	**Signature**
Sponsor	[redacted]	Director, Gas Transmission & Distribution	Approved; See email
Team Lead	[redacted]	Superintendent, Distribution	Approved; See email
Cause Evaluator	[redacted]	Quality Operations Specialist	Approved; see email

Milestone Timeline

Event/Action	Date	Comments
Incident	6/8/2023	
Classified as SIF Event	N/A	
Evaluation Kick-Off	6/21/2023	
Initial Comm Distributed	6/20/2023	
Extent of Condition Review Complete	6/26/2023	
Initial Approval (Sponsor, Team Lead, CE)	8/4/2023	
Reviewed by CARB	12/20/2023	*Results:* Incorporate comments and bring back.
Final Approved Report	2/29/2024	
Last Corrective Action Due Date	4/30/2024	
Effectiveness Review CAP Due Date	TBD	
Final Comm Distributed	TBD	

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Executive Summary

On June 7, 2023 PG&E crews responded to a Grade 3 leak at 15630 Alum Rock Ave. in San Jose (PM#44948405). As part of the leak repair process, two 4" Mueller line stopper fittings were successfully installed, and leak repairs were performed. Upon completion of the leak repairs, workers were in the process of installing and tightening two completion plugs with a wrench when a failure of the pressure boundary was experienced.

At approximately 0300am on June 8th, the final completion plug had been installed and was being tightened with a wrench when it inadvertently blew out of the fitting and exposed two coworkers to a direct stream of gas at distribution pressure. This resulted in an uncontrolled release of gas without ignition causing injuries to one coworker in the form of metal shavings lodged in their face and eyes.

Two coworkers working in the trench were evacuated and the crews were moved a safe distance from the gas stream. Emergency responders arrived and injured coworker was transported to a local hospital for treatment.

The Cause Evaluation (CE) Team conducted interviews with the injured coworker (ICW) along with other coworkers (CW1, CW2) who were at the work site at the time of incident. The team also collected the 4" Mueller line stopper fitting and the equipment used to perform the operations involved in an incident, as well as consulting with subject matter experts (SME) on the use of Mueller machines and fittings.

The CE Team completed a hazard barrier analysis of the expected controls around the work task, as well as utilized the HFACS (Human Factors Analysis and Classification System) to determine human performance precursors that may have contributed to the event.

After reviewing the collected information, documentation and related factors, the direct cause for this incident is inadequate thread engagement due to debris. This is based on the SME evaluation of the equipment post incident where minimal thread damage is present, and the equipment performed as designed.

Figure 1: Proper completion plug thread engagement.

The first apparent cause (AC1) is workers were qualified but not proficient with the Mueller Line Stopper process contained in Utility Procedure TD-4150P-202 "Mueller Line Stopper (M2) H-17190 and H-17191 2-Inch Through 4-Inch Operation Using D-Series Drilling Machine". The second apparent cause (AC2) is less than adequate (LTA) job preparation (job plan/instructions) provided to workers. The failure to perform procedure steps 7.14 and 7.15 for the reader to "attempt to raise boring bar to confirm completion plug engagement" was confirmed as all equipment was determined to be in serviceable condition post event.

The third apparent cause (AC3) is that procedural guidance in TD-4150P-202, step 7.22 does not have a mandatory requirement for the use of Personal Protective Equipment (PPE) when encountering an AOC. Utility Standard: SAFE-1005S "Personal Protective Equipment Standard" requires that "PG&E must provide and ensure that personnel use protection suitable for the exposure." In this case, the AOC stop work step was never entered and the standard eye protection that was sufficient for

Figure 2: Spring loaded equalization valve on 4" plug.

non-AOC conditions did not adequately protect against the risk of flying debris, including metal shavings.

A lack of proficiency combined with the failure to identify an AOC led them to further tighten the completion plug, which dislodged the only barrier between the workers and the energy source.

Immediate Actions

The following actions were taken immediately after the incident to ensure the safety of employees.

ICA#1: Grade 1 leak repaired; work area made safe.
Completed: 6/8/2023

ICA#2: Communication “Interim Controls to reduce Line of Fire hazard during installation of Completion Plug” distributed to Gas Operations, M&C / Leak Survey, GC, and Contract Partners.
Completed: 6/20/2023 via email.

ICA#3: Worker operator qualifications (OQ) pulled.
Completed: 6/8/2023

ICA#4: Add 5 Minute Meeting or tailboard as interim control. Topics to include mandatory requirement for the use of Personal Protective Equipment (PPE) when encountering an AOC. The intent is to implement before completion of Corrective Action 3 (CA-3).

The following report will provide insight into the conditions leading up to the incident, as well as detail the data gathered to analyze possible causes. Additionally, it will document how the data analysis determined the cause(s) and how the identified corrective actions will prevent or mitigate recurrence as required in GOV-6102S and/or GOV-6102P-06.

Problem Statement

Requirement, Standard, or Management Expectation:

- Utility Procedure: TD-4160P-42, “Installing Pressure-Control Fittings and Sleeves,” contains guidance for the safe installation and removal of completion caps on Mueller Line Stopper Split Fittings.

Deviation or Defect:

- On 6/8/2023, while installing a completion plug during a distribution system leak repair project, the completion plug became dislodged and failed.

Consequences:

- This resulted in a release of gas (Grade 1 leak) and projectile metal shavings that injured a coworker. The coworker was treated at a local hospital for injuries to the eyes and face caused by the metal shavings. The injured coworker is currently recovering at home pending additional treatment.

Significance:

- The failure of completion plugs to fully seat can cause gas leaks and potential injuries to workers. This incident has been reported as a Pipeline Hazardous Material Safety Administration (PHMSA) Serious Incident due to the hospitalization of the injured worker.

Extent of Condition (EOC)

The extent of condition (EOC) analysis for this event is limited to Mueller completion plugs in Gas operations. Per the inspection performed by the Methods and Procedures (M&P) pressure control group titled "Examination of Damaged Completion Plug" (Attachment B), it was determined that there is no condition present with the equipment or its application that would cause a repeat incident. Per the equipment evaluation performed (in Attachment B) "*We found the Mueller fitting and its components as well as the equipment utilized to perform the pressure control operations to be in satisfactory condition and suitable to safely perform this work*."

No additional actions are needed.

Causes

Direct cause: Inadequate thread engagement caused by debris in thread surfaces.
AC1: Workers were qualified but not proficient in the use of the Mueller machine. - Activity is infrequently performed by crews due to reduced use of Mueller machine. - Failure to check thread engagement after first few turns per procedure. - Inadequate thread engagement should have been visible to workers before attempting to tighten completion plug. - Workers may have been confused on differences between 2" and 4" plugs, as only 4" has spring loaded equalization plug that may sound like leaking gas bypassing O-ring.
AC2: Less than adequate (LTA) job preparation (job plan/instructions) provided to workers. - This combination led to workers who failed to identify an AOC condition and took the wrong step of further tightening the completion plug, which dislodged the only barrier between the workers and the energy source. - Workers failed to implement AOC under TD-4050P-202 step 7.22. - Gas leakage after removal of spring-loaded insert extractor should have been an immediate sign something is wrong (AOC).
AC3: TD-4150P-202, step 7.22 does not have a mandatory requirement for the use of Personal Protective Equipment (PPE) when encountering an AOC. - Utility Standard: SAFE-1005S "Personal Protective Equipment Standard" requires that "PG&E must provide and ensure that personnel use protection suitable for the exposure." - When abnormal conditions are met, procedure guidance in TD-4150P-202 requires workers to stop work (Step 7.22) and to: "*Consider using additional levels of PPE such as face shields and flash suits when encountering an abnormal operating condition (AOC)."* - This is a barrier that may have protected the coworker from the failure of the pressure boundary.

Corrective Actions

Cause # (RC,AC,CC)	Cause(s)	CA or CAPR#	CA/CAPR Description	Action Owner	Due Date
AC-1	**Apparent Cause Statement:** Workers were qualified but not proficient with the Mueller Line Stopper process contained in Utility Procedure TD-4150P-202. **NERC Cause Code:** A3-B1-C4 Infrequently performed steps were performed incorrectly	CA-1 (addresses AC-1 and AC-2)	**Type of Control:** Administrative **Action:** Virtual refresher training sessions for Mueller Line Stopper process. Training should reinforce the use of PPE when an AOC occurs. Videos to be profiled annually along with the OQ written test. **Deliverables to show completion:** Confirmation of training revision.	[redacted]	4/30/2024 Justification for due date: Develop revised training 90 days, closure actions 30 days.
AC-2	**Apparent Cause Statement:** Less than adequate (LTA) job preparation (job plan/instructions) provided to workers. **NERC Cause Code:** A5-B4-C2 Shift communications LTA	CA-2 (addresses AC-2)	**Type of Control:** Administrative **Action:** Roll out Streams application videos from Methods and Practices for proper use of Mueller devices as it pertains to applicable standards. This may be accomplished via 5 Minute Meeting email directed to users of Mueller equipment. **Deliverables to show completion:** Roster or email distribution of 5mm communication.	[redacted]	03/29/2024 Justification for due date: Adequate time to develop and distribute communication.

Cause # (RC,AC,CC)	Cause(s)	CA or CAPR#	CA/CAPR Description	Action Owner	Due Date
AC-3	**Apparent Cause Statement:** TD-4150P-202, step 7.22 does not have a mandatory requirement for the use of Personal Protective Equipment (PPE) when encountering an AOC. **NERC Cause Code:** A5-B2-C5 Ambiguous instructions / requirements	CA-3 (addresses AC-3)	**Type of Control:** Administrative **Action:** Revise the PPE Matrix for Tapping and Plugging to require the use of appropriate PPE upon identification of an AOC. **Deliverables to show completion:** Documentation of effective procedure revision.	[redacted]	05/30/2024 Justification for due date: Adequate time for procedure revision and associated change management.

Effectiveness Review Plan

See Appendix H.

Extent of Cause

N/A – Not required for non-SIF ACE's

Operating Experience (OE)

Internal Operating Experience:

A review of past CAPs was performed between 2020-current using the following search terms:

- Completion plug (80)
- Mueller (89)
- Line stopper (58)
- Eye injury (193)

The search yielded 420 hits, with zero relevant results. A discussion with a Mueller Machine Subject Matter Expert provided a cognitive search result of a similar eye injury incident in 2013 involving completion plugs (CAP #7000039). The CAP for the 2013 incident was reviewed:

Summary: Incident when a completion plug blew from a 3-inch M2 fitting because the completion plug was improperly inserted. The incident resulted in an employee sustaining injuries and a release of gas; the injuries were from projectile metal shavings that blew along with the completion plug at distribution pressure.

Corrective actions for this incident were to add specific procedure steps added to TD-4150P-200 series adding requirements for counting the number of turns during completion plug insertion and adding information about the number of turns required.

Methodology

To support a thorough understanding of tasks and work practices, subject matter experts were included on the investigation team.

During the evaluation, statements, and interviews along with incident and process-related documents were reviewed by the evaluation team and described in the analysis table.

Analysis

Analysis tools were selected for the cause evaluation to identify process breakdowns and to formulate effective corrective actions. The analysis tools are consistent with Enterprise Health & Safety procedures.

The following analysis tools were used by the evaluation team:

- Barrier Analysis
- Human Factors Analysis and classification system (HFACS)

Controls in Place at Time of Event (Barrier Analysis)

The CE Team evaluated what controls worked, failed, or were missing at the time of the incident to understand what drove the outcome of the event. (See Appendix J). Multiple failed or inadequate barriers were identified:

- **Personal Protective Equipment (PPE)**: Utility Standard: SAFE-1005S "Personal Protective Equipment Standard" requires that "PG&E must provide and ensure that personnel use protection suitable for the exposure." When abnormal conditions are met, procedure guidance in TD-4150P-202 requires workers to stop work (Step 7.22) and to: "*Consider using additional levels of PPE such as face shields and flash suits when encountering an abnormal operating condition (AOC)."* In this case, the AOC stop work step was never entered and the standard eye protection that was sufficient for non AOC conditions did not adequately protect against the risk of flying debris, including metal shavings.
  Based on interviews, the intent of this step is a stop work measure that is considered more conservative than only additional PPE, as we do not want workers proceeding in the face of uncertainty or for additional PPE to provide workers with a false sense of security. However, this step only protects workers when they look for and actively identify abnormal conditions to determine that additional PPE is needed.

- **Pre-job brief / JSSA:** Briefings adequately covered most applicable jobsite safety topics, including shoring, tool use and risks of deep piping. However, the AOCs specified in the procedure TD-4150P-202 were not covered or discussed. In addition, crews were not aware they were in an AOC condition when gas leakage was identified by crews.

- **Utility Procedure TD-4150P-202**: Per interviews, it was determined that procedure guidance was available at the jobsite. SMEs also determined that procedure guidance is adequate to safely perform Mueller work using the equipment involved in this incident if the procedure is performed as written.

  Guidance in TD-4150P-202 specifies that workers discontinue the procedure and take additional measures "IF gas pressure does not exhaust…" after opening bypass/relief valve or bleeder valve(s). In this incident, workers continued to attempt to tighten the completion plug and were unaware that leaking gas was an abnormal condition. Interviews with workers also identified workers were unsure how to proceed when leaking gas was present.

  While the final step of completion plug installation is to snug using a wrench, the presence of leaking gas along with the failure to achieve the proper amount of thread turns or revolutions should have caused an AOC and stop work condition.

- **Training/Proficiency:** No gaps in training or qualifications were identified. While workers are trained on both smaller and larger Mueller equipment, workers confused the release of gas as normal for 4" fittings which is incorrect. Workers state they are performing less Mueller work than in the past and may lack proficiency, which creates an error prone situation.

  Procedure TD-4150P-202 implements AOCs upon gas leakage, including work stoppage and the consideration of additional PPE requirements. Workers instead attempted to tighten the leaking plug until they experienced failure. Interviews determined the workers did not view the gas leakage as abnormal.

Human Factors Analysis & Classification System (HFACS)

HFACS tool is primarily designed to examine four broad categories developed to identify unsafe acts, identify the pre-conditions for the act/s to occur, and determine if supervisory or organizational level influences were present that allowed the event to occur. The HFACS analysis is summarized below. Based on the HFACS analysis, two key factors were identified that influenced this event. (See Appendix E).

Unsafe Acts: 1. Inadequate information gathering: Workers did not associate leaking gas with inadequate thread engagement but rather with O-ring issues. This may be due to proficiency issues and the failure to review AOC conditions before performing work.

2. Inadequate visual processing: The incident happened at approximately 0300 am with workers stated lighting was adequate. Workers routinely work at night and have headlamps and other additional lighting tools readily at their disposal. While the lack of thread engagement should be visible to the performer, it is not likely that illumination caused this to go unnoticed.

3. Perceptual errors: Inadequate tactile/haptic processing: The process of installing completion plugs uses tactile feel that is gained through years of experience. In this incident, workers were challenged with both limited opportunities to perform Mueller plug work activity and PPE gloves that reduce tactile feel. This is why the procedure (TD-4150P-202, step 7.15) requires that the thread engagement be checked after one full revolution to ensure adequate thread engagement.

Subject matter experts who later inspected the equipment determined that this step 7.15 was skipped, as all equipment was in serviceable condition and the completion plug could not be dislodged. One SME described the thread engagement as being so solid after step 7.15 that “you couldn’t dislodge it by beating on it with a hammer”.

Preconditions for Unsafe Acts: 1. Suboptimal ambient environment: Work takes place in an excavation at 0300 am with limited lighting. However, workers report lighting was adequate.

2. Fitness for Duty: No fitness for duty issues or reports of fatigue were identified during this investigation.

3. Planning – AOCs and stop work criteria in procedure TD-4150P-202 not discussed before starting work.

Supervisory Factors: Staffing/scheduling: During the course of the investigation, no evidence of time pressure or other workload related pressures were identified. (See Attachment A for work hour details).

Organizational Influences: Policies / Procedures: Procedure TD-4150P-202 suggests but does not require that additional protection be worn in AOC such as those experienced in this incident. Per the procedure:

Personal Protective Equipment (PPE)
Use appropriate PPE at all times, including but not limited to:
- *Safety glasses*
- *Long-sleeved shirt*
- *Gloves*

Consider using additional levels of PPE such as face shields and flash suits when encountering an abnormal operating condition (AOC).

NOTE: Immediate Corrective Action (ICA2) implements “*Full Face Protection (Face Shield / Welding Hood) recommended if a wrench is needed to tighten completion plug to achieve full seal*.”

Based on the results of the two analysis tools, gaps were identified in worker proficiency and in job preparation (job plan/instructions to workers issue). This combination led to workers who failed to identify an AOC condition and took the wrong step of further tightening the completion plug, which dislodged the only barrier between the workers and the energy source.

Equipment Evaluation

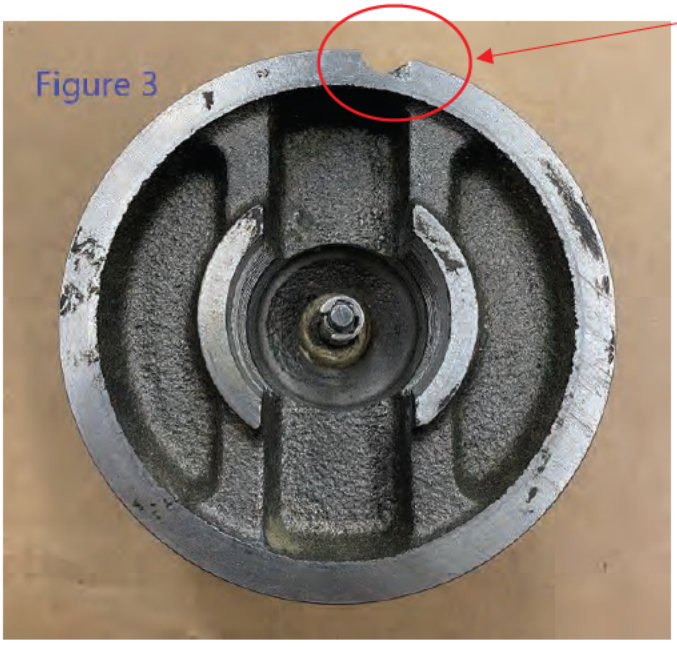
On June 8, 2023, the M&P pressure control group was called to investigate the mechanical integrity of the failed 4" Mueller line stopper fitting and the equipment used to perform the operations involved in this incident. M&P personnel were on site to witness the removal of pipe containing the fitting and took custody of the section of pipe, the fitting, and its components as well as all of the pressure control equipment utilized during the pressure control operations.

The pipe with fitting and all the pressure control equipment were brought to the Dublin facility where the fitting, its components, and the equipment were inspected for damage, defects, and operability.

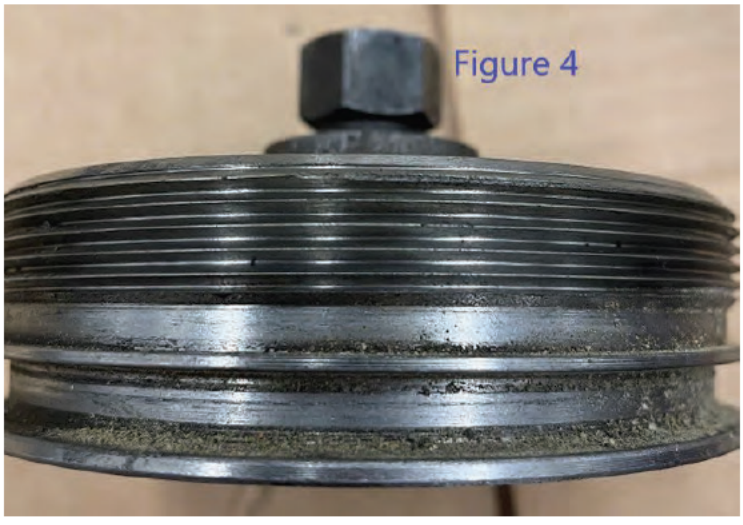
It was concluded by the M&P group that no material failures could be identified or replicated, and all equipment was in serviceable condition.

The following are highlights from the evaluation report:

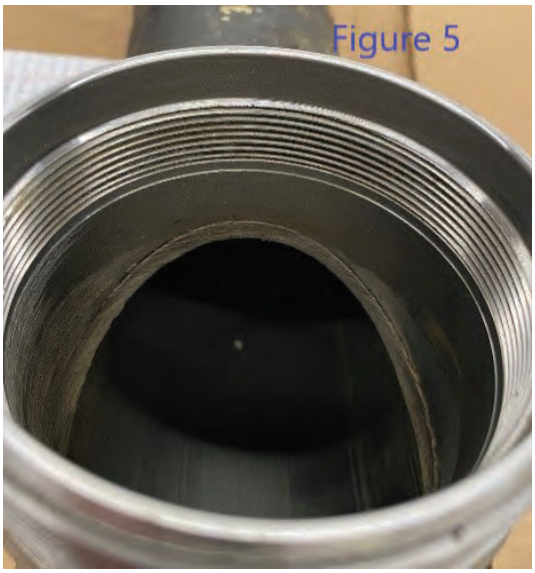
Examination of Damaged Completion Plug: Completion plug damage was noted measuring 0.41" wide and .18" deep at approximately 12 o'clock position (12 o'clock position was determined as closest linear point near damage; see Figure 3). Noted minor deformation on leading thread from 3 o'clock position extending to 5:30 position (see Figure 4).



NOTE: Completion Plug damage determined to have no bearing on worker inability to properly install.



Examination of Mueller H-17190 4" M2 Fitting: Minor damaged noted on leading internal completion plug thread between 12 o'clock and 2 o'clock positions (see Figure 5).



Inspection of D-5 Machine: Inspected all components no issues found .

Insertion of Completion Plug Under No Pressure: O-ring from replacement completion plug that was installed in M2 fitting was used in place of missing O-ring from damaged completion plug. Inserting equipment and damaged completion plug was installed onto D-5 drilling machine to perform insertion of completion plug.

1 full turn was completed, and boring bar was lifted, and thread engagement was confirmed. Ratchet handle was turned clockwise for 6 ½ additional turns equaling a total of 7 ½ turns falling into the 6 to 8 total turns needed to fully insert completion plug per table 15 (of Utility Procedure TD-4150P-202).

Conclusion: After extensive visual inspection and hands on operation of all equipment and fitting, following all applicable technical documents, we were unable to duplicate the incident that occurred in the field. We found the Mueller fitting and its components as well as the equipment utilized to perform the pressure control operations to be in satisfactory condition and suitable to safely perform this work.

Procedure Guidance

As part of this review, utility procedure TD-4150P-202 was reviewed for technical accuracy by PG&E SMEs. Discussions with SMEs initially identified two potential scenarios for the failure to secure adequate thread engagement, which are 1. The completion plug became cross threaded (low probability) or 2. Debris in the threads prevented the completion plug from threading (medium probability).

It was concluded that the procedure can be safely and effectively performed as written using the equipment involved in the incident. It was also determined that the procedure adequately addresses the two potential causes of the completion plug failure. Per TD-4150P-202:

"7 Inserting Completion Plug:

> *"7.14 Apply downward pressure on boring bar, AND rotate ratchet handle clockwise approximately 1 full turn until initial completion plug thread engagement is felt.*
> *7.15 Attempt to raise boring bar to confirm completion plug engagement.*
> *1. IF completion plug thread is not engaged, THEN repeat Step 7.13 and Step 7.14.*
>
> *"7.22 Open bleeder valve(s) on machine adapter nipple AND drilling machine, if applicable.*
> *1. IF gas pressure does not exhaust after opening bypass/relief valve or bleeder valve(s) AND number of turns listed in Table 15 did not occur, THEN discontinue this procedure, install additional fitting(s) to isolate the AOC, AND remove equipment to inspect and/or remove defective fitting."*

These steps were added in 2014 after a similar incident occurred where a 3" Mueller plug became dislodged and injured a coworker (see CAP 7000039). Cross threading (scenario #1) was later ruled out due to the lack of thread damage on both the completion plug and Mueller H-17190 4" M2 Fitting. However, step 7.22 would have identified the leaking gas upon cross threading and stopped work before the incident occurred.

Scenario #2 or the debris in the threads causing lack of thread engagement was determined the most plausible scenario by SMEs and should have been identified during steps 7.14 and 7.15. While debris were not present in the threads upon post incident inspection, it is postulated that the release of gas would have removed any such particles.

Interviews / Personnel Statements

The following personnel were interviewed by the investigation team and/or provided written statements.

Job Title (Current Position, Unless Noted)	Organization	Role During Event
Utility Worker/Coworker 1 (CW1)	M&C	Part of work crew
• Pretty generic tailboard don't know what's underground. Big focus that day was proximity of water lines to gas lines. • Arrived at Jobsite: Started probing, started taking gas reads. Street had grade. 2" gas line to 4" • First indication: Handed tool, put it on weld truck, walked back, see completion plug fly up. • Saw Coworker 2 and Injured Coworker covered. Made sure they were ok. Talked to traffic control see if they were going to call 911. Gas was blowing they couldn't hear anything else. They Double checked everyone was ok.		
Job Title (Current Position, Unless Noted)	**Organization**	**Role During Event**
Gas Mechanic/Coworker 2 (CW2)	M&C	Part of Work Crew
• In bell hole at time of incident. Injured coworker in bell hole also. Starting completion plug in m2. Top of fitting pancake valve, Mueller machine what you use to insert in fitting. Coworker 2 operated Mueller machine for plug when incident occurred. • Mueller machine insert bit into machine, put completion pug in there. Put in pancake valve, open valve and start running. • Mueller training – control fitting on pipe so we can service. Pancake is control. • Tightening completion plug with spanner wrench, machine is off on the last step. No concerns. Everything in process seemed normal. • Coworker went to tighten completion plug. Entire completion plug came out. • Around 3am morning 8th time of incident. • Jobsite was properly illuminated with light tower. • Improve training. Not enough on hands. More Repetition and proficiency.		
Job Title (Current Position, Unless Noted)	**Organization**	**Role During Event**
Foreman /Injured Coworker (ICW)	M&C	Part of Work Crew; foreman and equipment operator
• 12 years with company, equipment operator. Division gas crew 8-9 years. • 0700am morning tailboard office, job folders discussed at table. Job dispatched leak prepare much as can. Work on 4" gas main. Huddle go over job. Let guys know what were doing. Look at gauge of pipe. 1920s or 1930s pipe. • When you get on site. Concern couple months prior pretty deep might have to dig, might have to come back with shoring. Grade 3 below ground leak. Smaller readings but we picked up quite a bit of gas.		

Job Title (Current Position, Unless Noted)	Organization	Role During Event
• Job duties foreman and equipment operator. We found leaks 3-4 different spots, older gate valve got cut out and removed. Isolated between 2 valves, tapped and plugged down almost out of there. Last part of job. • Dry run performed with completion plug hand-tighten into pressure control fitting. • **We removed (Mueller) machine could hear little bit of gas. Dig control fitting pretty often completion plug blows gas. Maybe O ring busted, nothing was obvious.** • Removed machine, still heard gas. Only way tell broken O ring common 3" and 4". Only way to tell is to remove valve. Remove valve at that point, wasn't that. • Next step try to get spanner wrench tighten a little more before cap. About quarter turn plug flew out and shot up. • Any concerns? Different tools insertion and extraction. Had to make sure we had right tool. Did dry fit, make sure spin, insert plug. Explain to guy newer verified right tool. Landed one confirmed it. If you had the wrong tool wouldn't be able to screw down completion plug. • What AOC was encountered? We watch out for boring bar, could shoot up at you. • What AOC would make you stop? **I've seen gas coming out its not a concern.** Now, the pancake valve will remain on fitting and we will weld another.		

Based on interviews, the most likely cause of the completion plug dislodging is a lack of operator proficiency on the insertion of the completion plug. The interviews highlighted that workers were unsure what actions to take upon leaking gas from the completion plug. There were indications that workers should have identified as abnormal operating conditions (i.e. leaking gas, needing additional tightening of completion plug) and corresponding safety measures or controls that would likely have prevented the incident.

The mindset of the workers was that the leaking gas was normal, when in fact this is identified as an abnormal condition by the procedure that requires a work stoppage. All workers interviewed expressed a desire for additional training and experience on the Mueller equipment, as it is a less frequently performed activity as of late.

Analysis Conclusions:

The results of the causal analyses, which are summarized below, led to the identification of corrective actions to prevent, or reduce the likelihood of recurrence of this incident due to the identified cause(s).

	Direct cause: Inadequate thread engagement caused by debris in thread surfaces.
1	AC1: Workers were qualified but not proficient in the use of the Mueller machine. - Activity is infrequently performed by crews due to reduced use of Mueller machine - Failure to check thread engagement after first few turns per procedure - Inadequate thread engagement should have been visible to workers before attempting to tighten completion plug - Workers may have been confused on differences between 2” and 4” plugs, as only 4” has spring loaded equalization plug that may sound like leaking gas bypassing O-ring.
2	AC2: Less than adequate (LTA) job preparation (job plan/instructions) provided to workers. - This combination led to workers who failed to identify an AOC condition and took the wrong step of further tightening the completion plug, which dislodged the only barrier between the workers and the energy source. - Workers failed to implement AOC under TD-4050P-202 step 7.22. - Gas leakage after removal of spring-loaded insert extractor should have been an immediate sign something is wrong (AOC)
3	AC3: TD-4150P-202, step 7.22 does not have a mandatory requirement for the use of Personal Protective Equipment (PPE) when encountering an AOC. - Utility Standard: SAFE-1005S “Personal Protective Equipment Standard” requires that “PG&E must provide and ensure that personnel use protection suitable for the exposure.” - When abnormal conditions are met, procedure guidance in TD-4150P-202 requires workers to stop work (Step 7.22) and to: “Consider using additional levels of PPE such as face shields and flash suits when encountering an abnormal operating condition (AOC).” - This is a barrier that may have protected the coworker from the failure of the pressure boundary.

Additional Findings

AF-1 (CAP# 128119446): Evaluate if tools are available or can reasonably be developed to make Mueller process safer.
Owner: [redacted]

End of Executive Summary

Appendix A: Event Description

On June 7, 2023 PG&E crews responded to a Grade 3 leak at 15630 Alum Rock Ave. in San Jose (PM#44948405). As part of the leak repair process, two 4" Mueller line stopper fittings were successfully installed, and leak repairs were performed. Upon completion of the leak repairs, workers were in the process of installing and tightening two completion plugs with a wrench when a failure of the pressure boundary was experienced. All three individuals began workday on June 7th at approximately 7am, and continued work into 6/8 until the time of the incident. Coworker 2 arrived at Alum Rock incident jobsite at 2:30pm on June 7th.

At approximately 0300am on June 8th, the final completion plug to be installed inadvertently blew out of the fitting during wrench tightening and exposed two coworkers (CW2, ICW) to a direct stream of gas at distribution pressure. This resulted in an uncontrolled release of gas without ignition causing injuries to the employee operating the equipment in the form of metal shavings lodged in the face and eyes of the coworker. The injured coworker was also potentially struck in the head with either a tightening wrench and or the completion plug when the completion plug became dislodged.

Two coworkers working in the trench were evacuated and the crews were moved a safe distance from the gas stream. Emergency responders arrived and injured coworker was transported to a local hospital for treatment.

Background

Mueller line stoppers are used for various applications in pipeline systems to temporarily halt the flow of liquids or gases within the pipeline. Common uses for line stoppers include maintenance and repair, system modifications, and emergency responses. It is often necessary to isolate a specific section of a pipeline without shutting down the entire system. Line stoppers allow for localized isolation, enabling technicians to work on the designated area while maintaining flow in other parts of the pipeline.

In emergency situations, such as pipeline leaks or ruptures, line stoppers can be deployed to quickly isolate the affected area and allow for repairs. Section 7 of TD-4150P-202, "Inserting the Completion Plug", provides guidance on the process the workers were engaged in at the time of incident (see below).

7 Inserting the Completion Plug

7.1 Attach machine adapter nipple to body of drilling machine, ensuring body gasket is in place, AND tighten using smooth-faced wrench. (See Table 13 for part numbers.)
** For a complete listing of all tools and equipment, refer to GDS C-16.3.*
7.2 Close bleeder valve(s) on machine adapter nipple AND drilling machine, if applicable.
7.3 Assemble inserting tool and boring bar adapter. (See Table 14 for part numbers.)
*Table 14. Inserting Tool Part Numbers Tools and Equipment**
** For a complete listing of all tools and equipment, refer to GDS C-16.3.*
7.4 Attach inserting assembly to boring bar on drilling machine AND tighten using smooth-faced wrench.
7.5 Attach completion plug to inserting tool until threads bottom out.
NOTE: It may be necessary to rotate completion plug counterclockwise to align locking fork with completion plug.
7.6 Engage locking forks on the inserting tool into the completion plug. (See Figure 12.)

Figure 12. Inserting Tool and Completion Plug

2-Inch and 3-Inch Inserting Tool *4-Inch Inserting Tool*

7.7 Lubricate O-ring on completion plug by using Mueller rubber stopper lubricant (part number 580657).
7.8 Retract boring bar to its uppermost position.
7.9 Attach assembled drilling machine to control valve by simultaneously rotating drilling machine AND boring bar clockwise; tighten assembly by using smooth-faced wrench.
7.10 Retract boring bar to its uppermost position AND hold in place.
WARNING: Bodily injury or equipment damage may occur if upward motion of boring bar is not controlled.
1. IF using slide gate valve, THEN place bypass/relief valve in bypass position, if applicable.
7.11 Fully open control valve.
7.12 Attach ratchet handle to top of boring bar, AND place operating pin in clockwise position.
7.13 Advance boring bar until completion plug contacts threads in fitting.
7.14 Apply downward pressure on boring bar, AND rotate ratchet handle clockwise approximately 1 full turn until initial completion plug thread engagement is felt.
WARNING: Bodily injury or equipment damage may occur if upward motion of boring bar is not controlled.
7.15 Attempt to raise boring bar to confirm completion plug engagement.
1. IF completion plug thread is not engaged, THEN repeat Step 7.13 and Step 7.14.
7.16 Count number of full turns while rotating boring bar clockwise until completion plug comes to a positive stop.
7.17 Compare number of turns, including initial completion plug thread engagement, to number of turns required to fully insert completion plug. (See Table 15 for required number of turns.)
Table 15. Turns Required When Inserting Completion Plug
7.16 Release inserting tool as follows:
1. Place operating pin on ratchet handle in counterclockwise position.
2. Strike ratchet handle with a sharp blow by hand in a counterclockwise direction.
3. Rotate boring bar counterclockwise until disengaged from completion plug.
7.19 Retract boring bar to its uppermost position AND hold in place.
7.20 Remove ratchet handle from boring bar.
NOTE: A momentary flow of gas will exhaust from bypass/relief or bleeder valve.
7.21 IF using a slide gate valve, THEN place bypass/relief valve in relief position, if applicable.
7.22 Open bleeder valve(s) on machine adapter nipple AND drilling machine, if applicable.
1. IF gas pressure does not exhaust after opening bypass/relief valve or bleeder valve(s) AND number of turns listed in Table 15 did not occur,
THEN discontinue this procedure, install additional fitting(s) to isolate the AOC, AND remove equipment to inspect and/or remove defective fitting.

2. IF gas pressure does not exhaust after opening bypass/relief valve or bleeder valve(s) AND number of turns listed in Table 15 did occur,
THEN perform one of the following:
Discontinue this procedure, install additional fitting(s) to isolate the AOC, AND remove equipment to inspect and/or remove defective fitting.
OR
Assess/evaluate area for potential hazardous/gaseous atmosphere, AND perform the following steps:
(1) Identify which safety equipment and PPE are needed.
(2) Follow Step 7.23 through Step 7.28 to prepare fitting for completion plug extraction.
(3) Go to Section 2, "Extracting," AND follow Step 2.4 through Step 2.25 to remove and repair completion plug.
(4) Go to the beginning of Section 7, "Inserting Completion Plug," to insert completion plug.

Injured Worker Work Schedule for Prior Week

5/29 Company Holiday worked IR 10am- 5pm

5/30 7am -3:30pm

5/31 7am -3:30pm

6/1 7am -12pm – half day vacation

6/2 7am -3:30pm

6/3 6am – 7pm

6/4 Off

6/5 7am-9pm

6/6 7am-3:30pm

6/7 7am-12am

6/8 12am – Injury

Appendix B: Extent of Condition Worksheet

Tier	Object	Defect	Conclusion and Containment Actions
Same Object / Same Defect	Mueller 4" completion plug	Plug dislodged	**EOC Evaluation:** Subject matter experts secured the equipment and could not replicate the dislodged plug issue. Threads were intact and it is suspected that debris and failure to follow procedure guidance caused plug to dislodge. **Risk Exposure:** None. Equipment works as intended if procedure steps followed. **Containment Actions:** N/A
Same Object / Similar Defect	Mueller 4" completion plug	Plug leaked	**EOC Evaluation:** Subject matter experts secured the equipment and could not replicate the dislodged plug issue. Threads were intact and it is suspected that debris and failure to follow procedure guidance caused plug to dislodge. **Risk Exposure:** None. Equipment works as intended if procedure steps followed. **Containment Actions:** N/A

Appendix C: Extent of Cause Worksheet

N/A; not required for ACEs.

Appendix D: Hierarchy of Controls Analysis

Hierarchy of Controls	Potential Corrective Action	Specific	Measurable	Achievable	Reasonable	Timely	Recommend CA? (Y/N)
Elimination	1.Eliminate Mueller machines 2.	Y	Y	N	N	Y	No. Not possible at this time.
Substitution	1.Replace Mueller completion plugs with alternative 2.	Y	Y	N	N	Y	No. Not possible at this time.
Engineering	1. Develop tool to check thread engagement	Y	Y	Maybe	Y	Maybe	Yes. AF-2 to evaluate if tools are available or can reasonably be developed to make Mueller process safer.
Administrative	1. Review AOCs at pre-job brief. 2.	Y	Y	Y	Y	Y	Yes. CA1 to implement this action.
Personal Protective Equipment (PPE)	1.Face shield mandatory 2.	Y	Y	Y	N	Y	No. Workers are safest by stopping work and understanding what abnormal conditions are present, then only proceed when safe to do so. Existing procedure has guidance for face shields once work is stopped and AOC condition understood.

Appendix E: Cause and Corrective Action Matrix

Cause # (RC,AC,CC)	Cause(s)	CA or CAPR#	CA/CAPR Description	Action Owner	Due Date
AC-1	**Apparent Cause Statement:** Workers were qualified but not proficient with the Mueller Line Stopper process contained in Utility Procedure TD-4150P-202. **NERC Cause Code:** A3-B1-C4 Infrequently performed steps were performed incorrectly	CA-1 (addresses AC-1 and AC-2)	**Type of Control:** Administrative **Action:** Virtual refresher training sessions for Mueller Line Stopper process. Training should reinforce the use of PPE when an AOC occurs. Videos to be profiled annually along with the OQ written test. **Deliverables to show completion:** Confirmation of training revision.	[redacted]	4/30/2024 Justification for due date: Develop revised training 90 days, closure actions 30 days.
AC-2	**Apparent Cause Statement:** Less than adequate (LTA) job preparation (job plan/instructions) provided to workers. **NERC Cause Code:** A5-B4-C2 Shift communications LTA	CA-2 (addresses AC-2)	**Type of Control:** Administrative **Action:** Roll out Streams application videos from Methods and Practices for proper use of Mueller devices as it pertains to applicable standards. This may be accomplished via 5 Minute Meeting email directed to users of Mueller equipment. **Deliverables to show completion:** Roster or email distribution of 5mm communication.	[redacted]	03/29/2024 Justification for due date: Adequate time for corrective action implementation.

Cause # (RC,AC,CC)	Cause(s)	CA or CAPR#	CA/CAPR Description	Action Owner	Due Date
AC-3	**AC-3 Apparent Cause Statement:** TD-4150P-202, step 7.22 does not have a mandatory requirement for the use of Personal Protective Equipment (PPE) when encountering an AOC. **NERC Cause Code:** A5-B2-C5 Ambiguous instructions / requirements	CA-3 (addresses AC-3)	**Type of Control:** Administrative **Action:** Revise the PPE Matrix for Tapping and Plugging to require the use of appropriate PPE upon identification of an AOC. **Deliverables to show completion:** Documentation of effective procedure revision.	[redacted]	5/30/2024 Justification for due date: Adequate time for procedure revision and associated change management.

Appendix F: Operating Experience (OE)

Internal OE:

A search for relevant internal events was conducted to determine whether the condition(s) resulting in this incident occurred previously inside PG&E. This historic data review provides the opportunity to review previous corrective actions (CAs) for effectiveness, and whether the proposed CAs are like previous CAs.

The following search criteria were queried within PG&E's Corrective Action Program (CAP) database against all open and closed events submitted to CAP between 01/01/2020 and 7/12/2023.
The search output yielded the following results:

- 80)
- Mueller (89)
- Line stopper (58)
- Eye injury (193)

CAP Key Words / Attributes	Number of Results	Total Relevant Results
Completion plug	80	0
Mueller	89	0
Line stopper	58	0
Eye injury	193	0

Of these results, no relevant CAPs were identified. A discussion with a Mueller Machine SME provided a cognitive search result of a similar eye injury incident in 2013 involving completion plugs. The CAP for the 2013 incident was reviewed:

CAP Issue # / Evaluation Type	Event Title / Location	Event date
7000039	**Escaping Gas Serious Injury**	**10/18/2013**
Summary of Incident	Two Sacramento M&C employees were injured from debris in the gas stream escaping from a blowing 3# M-2 pressure control fitting. The incident resulted in an employee sustaining injuries and a release of gas; the injuries were from projectile metal shavings that blew along with the completion plug at distribution pressure. (NOTE: Limited details are provided in original 2013 CAP).	
Identified Causes	A completion plug blew from a 3-inch M2 fitting because the completion plug was improperly inserted.	
Corrective Actions	Revision of following procedures: • TD-4150P-200 - "Mueller Line Stopper (M2) H-17190 ¾-inch and 1-inch Operation Using E-Series Drilling Machine," Rev. 1 • TD-4150P-201 - "Mueller Line Stopper (M2) H-17190 1¼-inch Operation Using E-Series Drilling Machine," Rev. 1 • TD-4150P-202 - "Mueller Line Stopper (M2) H-17190 and H-17191 2-inch through 4-inch Operation Using D-Series Drilling Machine," Rev. 1 Critical safety steps were added to these revisions to address hazards identified, including:	

	In the "Before You Start" section, additional personal protective equipment (PPE) is specified. In Section 7, "Inserting the Completion Plug," added requirements for counting the number of turns during completion plug insertion and added information about the number of turns required. In Section 7, also added information addressing Abnormal Operating Conditions (AOCs) encountered during insertion procedure.
Analysis Summary	A Process Safety review was conducted on these procedure updates to address the hazard, with specific procedure steps added to Section 7 adding requirements for counting the number of turns during completion plug insertion and adding information about the number of turns required. These three document revisions address part of the incident action plan and subsequent Corrective Action Program (CAP) (7000039).

External OE *(Required for RCE)*

N/A; not required for ACE.

Appendix G: Additional Findings

Additional Findings: Conditions identified during an investigation, which are not causes, but that need to be addressed. They do not correct the problem, nor do they make it worse.

AF-1 (CAP# 128119446): Evaluate if tools are available or can reasonably be developed to make Mueller proces
Owner: [redacted]

Appendix H: Effectiveness Review Plan

Criteria	*Plan: Description*	
Attributes	*Dislodged completion plug*	**CAP #** **TBD**
Method	Observe a minimum of ten completion plug activities in the field against the standards in Utility Procedure TD-4150P-202 "Mueller Line Stopper (M2) H-17190 and H-17191 2-Inch Through 4-Inch Operation Using D-Series Drilling Machine".	**CAP Owner:** [redacted]
Success	Verify that performers demonstrate 100% proficiency with the critical and relevant portions of the Mueller completion plug process contained in TD-4150P-202.	
Timeliness	The effectiveness review data gathering process will begin on 10/30/2024, approximately 6 months after implementation of the last corrective action. Within 60 days of 10/30/2024 all gathered data will be reviewed and findings will be documented in the EFFR final report, approved by the Corrective Action Review Board (CARB), and the EFFR CAP issue will be closed.	**Due date:** 12/14/2024

Appendix I: Data Reviewed

Documents and Materials

The following process related documents and materials were analyzed by the evaluation team.

	Documents Reviewed:	Key Findings:
1	Guidance Tailboard: Mueller Line Stopper TAILBOARD ISSUED: November 5, 2014	Corrective actions from similar injury incident in 2013. Added requirements for counting the number of turns during completion plug insertion and added information about the number of turns required. Also added information addressing Abnormal Operating Conditions (AOCs) encountered during insertion procedure.
2	Job Site Safety Analysis (JSSA) for Order 35457788 - 45829182 - 44948405	Standard JSSA for worksite conditions. No findings.
3	Work Clearance Document. 80229510	For Grade 1 leak after incident. No findings.
4	Preliminary investigation for 15630 Alum Rock Ave for PM#44948405	Details inspection of equipment involved in incident. Findings: Per report "After extensive visual inspection and hands on operation of all equipment and fitting, following all applicable technical documents, we were unable to duplicate the incident that occurred in the field. We found the Mueller fitting and its components as well as the equipment utilized to perform the pressure control operations to be in satisfactory condition and suitable to safely perform this work"
5	Safety Advisory - Interim Controls to reduce Line of Fire hazard during installation of Completion Plug	Interim actions post incident. No findings.
6	TD-4150P-202: Mueller Line Stopper (M2) H-17190 and H-17191 2-Inch Through 4-Inch Operation Using D-Series Drilling Machine	Procedure steps are safe and able to be performed as written. Procedure is based on manufacturer guidance.
7	Checklist for Gas Distribution As-Built Package	No findings.
8	Gas Carrier Pipe Checklist	No findings.
9	Hot Work Checklist	No findings.

Appendix J: Analysis Tools

UNSAFE ACTS	
HFACS Framework factors and definitions	**HFACS worksheet required documentation**
ERRORS	
N/A ☐ **Skill-based Errors** - Often occur during the performance of highly practiced activities that do not require much concentration	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Incorrect Action** – inadvertent, misordering, mistiming of response. ☒ **Omitted Action** – missing steps in a procedure, place-losing, forgetting intentions. ☒ **Improper technique** – inappropriate performance method for the situation (speed/timing/positioning)	☐ **Incorrect Action** ☒ **Omitted Action:** Step 7.14 and 7.15 of TD-4150P-202 instructs to attempt to raise boring bar after one full turn and confirm completion plug engagement. This step was missed as threads are intact and would have confirmed loose completion plug. ☒ **Improper technique:** Presence of gas leak after tightening did not cause worker to implement AOC as required by procedure. There may have been confusion between the 2" and 4" completion plugs as the 4" is spring loaded and should not have allowed gas venting. Additional wrench tightening was not the correct technique for addressing gas leaks.
N/A ☐ **Decision Errors** – Often occur during the performance of diagnostic or problem-solving tasks that require conscious effort	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☒ **Inadequate information gathering** – limited search, disregarding/ignoring relevant cues. ☐ **Inadequate situation assessment** – failure to recognize patterns/relationships among cues, focusing on irrelevant information. ☐ **Inadequate action/response selected** – inaccurate/risky action chosen; failure to prioritize actions.	☒ **Inadequate information gathering:** Workers did not associate leaking gas with inadequate thread engagement but rather with O-ring issues. ☐ **Inadequate situation assessment** ☐ **Inadequate action/response selected.**
N/A ☐ **Perceptual Errors** - Often occur during the performance of tasks that rely heavily on one's senses for detecting/interpreting stimuli in the environment	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.

Check all that apply. ☐ **Inadequate visual processing** – misjudged height/distance, misinterpreted text/numbers, misperceived colors/shapes ☐ **Inadequate auditory processing**– misinterpreted speech, misperceived tones/sounds ☐ **Inadequate tactile/haptic processing** – misestimating weight/force/pressure	☐ **Inadequate visual processing:** Lighting was determined adequate. Happened at approximately 3am, workers stated lighting was adequate to perform work. ☐ **Inadequate auditory processing** ☐ **Inadequate tactile/haptic processing:** Process of installing Completion plugs uses tactile feel that is gained through experience. The use of PPE gloves can challenge workers inexperienced workers. This is why procedure steps 7.14 and 7.15 to "attempt to raise boring bar to confirm completion plug engagement" are critical when gloves are in use as they mitigate the loss of tactile feel.
VIOLATIONS / DEVIATIONS	
N/A ☒ **Routine Violations** – Intentional "bending" of the rules; habitual deviation from the rules and tolerated by management	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Short-cuts** – working around established protocols, intentionally skipping steps in a procedure. ☐ **Inappropriate use of tools/technology** – disabling alarms, removing safety guards ☐ **Disregarding orders/direction** – ignoring supervisor's instructions, noncompliance with safety warnings.	☐ **Short-cuts** ☐ **Inappropriate use of tools/technology** ☐ **Disregarding orders/direction**
N/A ☒ **Exceptional Violations** – Isolated deviation from the rules but NOT indicative of one's behavior or tolerated by management	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Unqualified actions** – performing activities without license/credentials. ☐ **Disruptive behavior**– arguing, physical altercations, abusing equipment. ☐ **Excessive risk taking** – actions that pose unreasonable risk of harm, negligence.	☐ **Unqualified actions** ☐ **Disruptive behavior** ☐ **Excessive risk taking**
PRECONDITIONS FOR UNSAFE ACTS	
SITUATIONAL FACTORS	
N/A ☐ **Physical Environment** – Refers to the setting in which individuals or teams perform their work	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.

Check all that apply. ☐ **Suboptimal ambient environment** – poor lighting, temperature, noise ☐ **Suboptimal workplace design** – poor layout, location/distribution of materials ☐ **Suboptimal housekeeping** – cluttered, disorganized, unclear	☐ **Suboptimal ambient environment:** Work takes place in excavation at 3am with limited lighting. Workers stated not an issue as night work is common and headlamps and supplemental lights were on jobsite. ☐ **Suboptimal workplace design** ☐ **Suboptimal housekeeping**
N/A ☒ **Tools/Technology** – Refers to the materials, software and documents individuals and teams use to perform their work	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Inadequate design** – confusing, cumbersome, inflexible, incompatible ☐ **Inadequate condition** – outdated, poorly maintained, malfunctioning.	☐ **Inadequate design** ☐ **Inadequate condition**
CONDITION OF OPERATORS	
N/A ☒ **Mental States** – Refers to mental conditions that may negatively affect performance	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Cognitive Factors** – attention/memory failures, confusion, inaccurate expectations ☐ **Motivation/Arousal** – complacency, haste, overconfident, boredom, frustration, drowsiness	☐ **Cognitive Factors** ☐ **Motivational/Arousal**
N/A ☒ **Physiological States** – Refers to the individual's medical/physiological condition at the time of the event	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Physiological Factors** – illness dehydration, hypoglycemia, circadian dysrhythmia ☐ **Physical Factors** – muscle fatigue, inadequate stature, strength, dexterity	☐ **Physiological Factors** ☐ **Physical Factors**
N/A ☒ **Physical/Mental Limitations** – Refers to permanent physical/mental disabilities that may adversely impact performance	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Physical Limitations** – obesity, injury, disability, sensory deficits ☐ **Mental Limitations** – lack of experience, knowledge, or aptitude	☐ **Physical Limitations** ☐ **Mental Limitations**
PERSONNEL FACTORS	

N/A ☒ **Communication, Coordination and Planning** – Refers to the interrelationship among team members	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Failure to provide/request information** – shared or request information is incomplete, delayed, or unclear. ☐ **Failure to confirm information** – failure to ensure that information sent/received as understood. ☒ **Inadequate planning** – failure to prepare, conduct briefing, or ensure role clarity. ☐ **Inadequate monitoring/backup** – failure to support team members or assist others in performing activities.	☐ **Failure to provide/request information.** ☐ **Failure to confirm information.** ☒ **Inadequate planning:** Briefings adequately covered most applicable jobsite safety topics, including shoring, tool use and risks of deep piping. However, the AOCs specified in the procedure TD-4150P-202 were not covered or discussed. While stressed in the procedure, crews were not aware they were in an AOC condition when gas leakage was identified. ☐ **Inadequate monitoring/backup**
N/A ☒ **Fitness for Duty** – Refers to activities performed off the job that influence an individual's ability to perform their work safely	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Poor dietary/health practices** – consuming too much alcohol, not maintaining weight/health, too little exercise. ☐ **Failure to get adequate rest** – working a second job, limiting sleep, overexertion.	☐ **Poor dietary/health practices** ☐ **Failure to get adequate rest.**
SUPERVISORY FACTORS	
N/A ☒ **Inadequate Supervision** – Refers to the performance of basic supervisory activities	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Failure to provide adequate guidance** – inadequate mentoring/coaching, failure to communicate policies, procedures, performance expectations. ☐ **Failed to provide adequate oversight** – inadequate monitoring of work activities, lack of presence within the work environment, failure to stay engaged with the workforce. ☐ **Failed to provide adequate training** – inadequate instruction/education, failure to ensure staff qualifications, currency, and training.	☐ **Failure to provide adequate guidance.** ☐ **Failed to provide adequate oversight.** ☐ **Failed to provide adequate training.**
N/A ☒ **Planned Inappropriate Operations** – Refers how staff and work activities are managed	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.

Check all that apply. ☐ **Inadequate staffing/scheduling** – failure to ensure enough staff are available, requiring staff to work excessive overtime or unreasonable shift rotations. ☐ **Inadequate workload assignment** – failure to match staff competency with tasks, assigning unreasonable workload or tempo.	☐ **Inadequate staffing/scheduling** ☐ **Inadequate workload assignment**: No time pressure or other workload issues were identified during the course of the investigation..
N/A ☒ **Failure to Correct Known Problems** – Refers to the correction of known deficiencies by the supervisor	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Failed to correct inappropriate behavior** – not enforcing the rules, failure to address suboptimal performance, failure to resolve staff conflicts. ☐ **Failed to correct workplace problems** – failure to adequately maintain/repair equipment, failure to review and revise policies/procedures.	☐ **Failed to correct inappropriate behavior.** ☐ **Failed to correct workplace problems.**
N/A ☒ **Supervisory Violations** – Refers to supervisor's intentional disregard for rules	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Authorizing noncompliance**– instructing staff to circumvent procedures, requiring staff to engage in unsafe practices. ☐ **Supervisor noncompliance** – performing supervisory activities that intentionally break the rules, such as falsifying records.	☐ **Authorizing noncompliance** ☐ **Supervisor noncompliance**
ORGANIZATIONAL INFLUENCES	
N/A ☒ **Organizational Culture** – Priority placed on safety relative to organizational goals/initiatives	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Values** – revenue generation supersedes safety, limited recognition/rewards for safety performance or for reporting safety hazards. ☐ **Commitment** – compliance with safety regulations is primary goal, proactive safety initiatives received minimal support. ☐ **Transparency** – adverse events are concealed, lessons learned from mistakes are not shared throughout the organization.	☐ **Values** ☐ **Commitment** ☐ **Transparency**
N/A ☒ **Operational Process** – Refers to how an organization plans to achieve its objective	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.

Check all that apply. ☐ **Strategic planning** – conflicting priorities, competing initiatives, unrealistic objectives. ☐ **Policies / Procedures** – conflicting or ambiguous policies, limited development or dissemination of procedural guidance ☐ **Corporate oversight** – lack of leadership engagement or appreciation of risks	☐ **Strategic planning** ☐ **Policies / Procedures** ☐ **Corporate oversight**
N/A ☒ **Resource Management** – Refers to the support provided to accomplish the objectives of the organization	**Justification:** - Check all that apply - Cite all specific findings from your investigation as applicable and note supporting evidence for each checked box. - Document N/A for any unchecked boxes.
Check all that apply. ☐ **Human resources** – poor practices associated with recruiting and retaining personnel. ☐ **Equipment / Facility resources** – limited acquisition of necessary equipment/technology ☐ **Monetary resources** – budgetary constraints, excessive cost cutting, unfunded mandates.	☐ **Human resources** ☐ **Equipment / Facility resources** ☐ **Monetary resources**

Barrier Analysis Worksheet				
Target:	Mueller Completion Plugs			
Hazard:	Completion Plug failure and subsequent worker injury			
What Were the Barriers / Controls?	**How did Each Barrier Perform?**	**Why did the Barrier Fail?**	**How did the Barrier Affect the Occurrence?**	**Context**
PPE	Failed	Because AOC not recognized nor implemented which would have stopped work and would require face shield and additional safety controls when safe to resume work	Worker received metal shaving injuries. Standard PPE safety glasses are not sufficient to protect against metal shavings when AOC present	

Barrier Analysis Worksheet				
Target:	Mueller Completion Plugs			
Hazard:	Completion Plug failure and subsequent worker injury			
What Were the Barriers / Controls?	**How did Each Barrier Perform?**	**Why did the Barrier Fail?**	**How did the Barrier Affect the Occurrence?**	**Context**
Pre-job brief / JSSA	Failed	Briefings adequately covered safety, including shoring, tool use and risks of deep piping. However, AOC not covered for this scenario.	AOC was not immediately identified by crews until after incident.	Recommend expectation that AOCs are discussed during pre-job brief.
Utility Procedure TD-4150P-202	Not utilized	Specific steps in the procedure cover this situation as an AOC. Workers also failed to challenge thread engagement after one full turn.	Failure to implement procedure as written caused worker to not have correct PPE and to continue when job should have been stopped.	
Training	Not applicable	Training covers both 2" and 4" Mueller plugs, machines and their safe use.	Workers understood how to perform work.	Workers lacked proficiency (i.e. tactile feel, 2" vs 4" and gas leakage) but were knowledgeable on how to perform work.
Proficiency	Failed	Workers confused the release of gas as normal and attempted to tighten completion plug until failure.	Procedure implements AOC including work stoppage and additional PPE upon leaking gas.	Workers are performing less Mueller work and lack proficiency; error prone situation.
Mueller Machine / Valve	Not applicable	Plug was not installed and challenged per guidance. This caused lack of thread engagement.	Plug and machine are in serviceable condition. Proper installation and checking thread engagement would have prevented incident.	

Appendix K: Report Revision Summary

Report Version	Change Summary- Describe any major changes from previous version
DRAFT	Working document prior to Sponsor Approval
Approved by Sponsor, Cause Evaluator, Team Lead	Improve corrective action focus to include all known risk work activities. Previous action was narrowly focused on Mueller work.
ECAP Director Review	N/A
CARB Reviewed	Approved w/ comments Change additional finding AF1 to apparent cause AC-3? Add 5MM/tailboard as interim control share prior to completion of CA
Final Approved report	CARB Comments addressed and approved.

Appendix L: Attachments to Incident CAP

☒ Attachment 1: Charter

☒ Attachment 2: Cause Evaluator Qualification

☒ Attachment 3: All Documents and Materials listed on Appendix I

From: [redacted]
To: [redacted]
Cc:
Subject: RE: Completion Plug ACE
Date: Friday, March 1, 2024 6:36:08 AM

Classification: Internal

Looks good to me ,approved [redacted]. Thanks!

[redacted]
Director, Region 4 (SB/CC)
M&C/Field Services/Corrosion/Leak Survey
[redacted] CELL

From: [redacted]
Sent: Thursday, February 29, 2024 5:01 PM
To: [redacted]
Cc: [redacted]
Subject: Completion Plug ACE

Classification: Internal

[redacted] and [redacted],

Attached for your review is 126324897 Completion Plug ACE Revision 1 to make minor editorial change to correct wording of AC-3. If you would, please indicate approval and I will forward to [redacted]

Thanks,

[redacted] | PG&E | Gas CAP

From: [redacted]
To: [redacted]
Cc: [redacted]
Subject: RE: Completion Plug ACE
Date: Friday, March 1, 2024 6:16:43 AM

Classification: Internal

Reviewed and approved.

[redacted] – Region 4 Gas Distribution Superintendent
Pacific Gas & Electric | Gas OM&C
401 Work St | Salinas, California | United States
Cell [redacted]

From: [redacted]
Sent: Thursday, February 29, 2024 5:01 PM
To: [redacted]
Cc: [redacted]
Subject: Completion Plug ACE

Classification: Internal

[redacted] and [redacted]

Attached for your review is 126324897 Completion Plug ACE Revision 1 to make minor editorial change to correct wording of AC-3. If you would, please indicate approval and I will forward to [redacted]

Thanks,

[redacted] | **PG&E** | **Gas CAP**

From: [redacted]
To:
Cc:
Subject: RE: Completion Plug ACE - PPE Matrix Line Item
Date: Wednesday, January 31, 2024 4:05:58 PM
Attachments: image001.png

Classification: Internal

Looks good [redacted]

[redacted]
Director, Region 4 (SB/CC)
M&C/Field Services/Corrosion/Leak Survey
[redacted] CELL

From: [redacted]
Sent: Tuesday, January 30, 2024 11:07 AM
To: [redacted]
Cc: [redacted]
Subject: FW: Completion Plug ACE - PPE Matrix Line Item

Classification: Internal

Hello [redacted] and [redacted]

Per our T/C, attached is the revised report draft with changes to Corrective Action #2 (below). Please let me know if you have any additional wording recommendations or if due date should be adjusted.

Thanks,
[redacted]

AC-2	**Apparent Cause Statement:** Less than adequate (LTA) job preparation (job plan/instructions) provided to workers. **NERC Cause Code:** A5-B4-C2 Shift communications LTA	CA-2 (addresses AC-2) -	**Type of Control:** Administrative **Action:** Roll out Streams application videos from Methods and Practices for proper use of Mueller devices as it pertains to applicable standards. This may be accomplished via 5 Minute Meeting email directed to users of Mueller equipment. **Deliverables to show**	[redacted]	03/29/2024 Justification for due date: - Adequate time to develop and distribute communication.

			completion: Roster or email distribution of 5mm communication.		

From: [redacted]
Sent: Tuesday, January 30, 2024 9:42 AM
To: [redacted]
Subject: RE: Completion Plug ACE - PPE Matrix Line Item

Classification: Internal

Hi [redacted]

What would be a reasonable due date for this action? Please let me know and I will adjust accordingly.

Thanks,
[redacted]

From: [redacted]
Sent: Tuesday, January 30, 2024 6:44 AM
To: [redacted]
Subject: RE: Completion Plug ACE - PPE Matrix Line Item

Classification: Internal

Hey [redacted]
It looks good. I'm a little concerned about the due date on CA-2, we are a ways away from something that is tangible in that space. I think that was [redacted] and my concerns as we continue to run that to ground. Any thoughts?

AC-2	**Apparent Cause Statement:** Less than adequate (LTA) job preparation (job plan/instructions) provided to workers. **NERC Cause Code:** A5-B4-C2 Shift communications LTA	CA-2 (addresses AC-2)	**Type of Control:** Administrative **Action:** Develop and implement a tool to allow field crews the ability to scan a barcode or QR code sticker and quickly reference procedures, job aides, or supplemental documents via a web link. **Deliverables to show completion:** Perform a proof of concept for selected Mueller procedures (TP-4150 series) within M&C.	[redacted]	03/29/2024 Justification for due date: Adequate time for corrective action implementation.

[redacted]
Director, Region 4 (SB/CC)

M&C/Field Services/Corrosion/Leak Survey
[redacted] CELL

From: [redacted]
Sent: Tuesday, January 23, 2024 3:54 PM
To: [redacted]
Subject: FW: Completion Plug ACE - PPE Matrix Line Item

Classification: Internal

Hello [redacted]

Attached for your review is the draft report for 126324897 "GO San Jose Completion Plug Dislodging" with CARB comments incorporated in "Red Track Changes." If you approve of changes, I will incorporate into final PDF version.

I've also included the CARB comments below as a reference for you to compare against.

Thanks,
[redacted]

-

From: [redacted]
Sent: Tuesday, December 26, 2023 6:59 AM
To: [redacted]
Cc: [redacted]
Subject: RE: Completion Plug ACE - PPE Matrix Line Item

Classification: Internal

Thanks [redacted] looks good to me.

[redacted]
Director, Region 4 (SB/CC)
M&C/Field Services/Corrosion/Leak Survey
[redacted] CELL

From: [redacted]
Sent: Friday, December 22, 2023 12:14 PM
To: [redacted]
Cc: [redacted]
Subject: Completion Plug ACE - PPE Matrix Line Item

https://sapgwp.pge.com/pge/learning/index.html#/transcripts

My Transcript

TECH-9164WBT	Distracted Driving (90Min)	Web-Based Training	10/27/2023	10/30/2023	v2.3	n/a	0.00	Passed
CORP-6020WBT	CE Roles and Responsibilities (60Min)	Web-Based Training	10/27/2023	10/27/2023	v1.0	n/a	0.00	Passed
ECAP-CE_OJT	ECAP CE OJT	Instructor Led Training	10/24/2023	10/24/2023		Santa Rosa - Unspecified	0.00	Passed
CORP-6021	Cause Evaluation Annual Refresher	Instructor Led Training	10/24/2023	10/24/2023		Santa Rosa - Unspecified	0.00	Passed
GAS-0174WBT	Utilizing the O&M Manual (60Min)	Web-Based Training	10/23/2023	10/23/2023	v1.1	n/a	0.00	Passed
TECH-9164WBT	Distracted Driving (90Min)	Web-Based Training	10/23/2023	10/23/2023	v2.3	n/a	0.00	Passed
TECH-9162WBT	Defensive Driving-Small Vehicles (30Min)	Web-Based Training	10/20/2023	10/20/2023	v3.1	n/a	100.00	Passed
TECH-9164WBT	Distracted Driving (90Min)	Web-Based Training	10/20/2023	10/20/2023	v2.3	n/a	0.00	Passed
CORP-6011	ECAP Cause Evaluation Training	Instructor Led Training	09/12/2023	09/14/2023		San Ramon Valley Conference Center	0.00	Passed

SIF-Potential Apparent Cause Evaluation (ACE) Team Charter

Issue Title:	Completion Plug Failure		
CAP Number:	126324897	**Date of Incident:**	6/9/2023
Line of Business:	M&C / Leak Survey - SJ / DA / CC	**Department:**	Gas

Name	Role	Department / Position	LAN / Email	Phone #
[redacted]	Sponsor	Director, Gas Transmission & Distribution	[redacted]	N/A
[redacted]	Team Lead	Superintendent, Distribution	[redacted]	N/A
[redacted]	Cause Evaluator	Cause Evaluator	[redacted]	N/A

Scope of Investigation

The causal evaluation will determine the conditions that led to the deviation(s) listed in the problem statement and identify corrective actions to address them.

Methodology

The cause evaluation will be performed in accordance with GOV-6102S "Enterprise Cause Evaluation Standard" following guidance in GOV-6102P-06 "Enterprise Cause Evaluation Procedure" and GOV-6102M "Cause Evaluation Manual". The analytic methods used for the evaluation shall include at a minimum Barrier Analysis and Human Factors Analysis & Classification System (HFACS).

CE Team General Working Agreements:

- ☐ The team has 45 days to complete the evaluation on time with ECAP approval by 9/4/2023.
- ☐ Commit to working 3-4 hrs per day until the causes and corrective actions are identified. Have an alternate representative attend meetings if unexpected challenges arise.
- ☐ **Ask for support or assistance if experiencing time commitment challenges or unexpected roadblocks**. Escalate if necessary to the Sponsor, ECAP Director, EH&S Manager, LoB CAP Manger, LoB leadership, etc. to get the situation resolved ASAP.
- ☐ Attend meetings on-time and prepared to collaborate.
- ☐ Stay committed and engaged with the team until all tasks are completed.
- ☐ Encourage and provide space for everyone to participate and welcome alternative perspectives.
- ☐ Focus on keeping within the scope of the evaluation. Avoid going off on tangents not related to the issue at hand.
- ☐ Avoid looking for "who" failed and instead identify "what" failed. Use facts and evidence, NOT speculation. Don't assume the answer is known.
- ☐ Maintain confidentiality.

CE Team Resources & Responsibilities:

Sponsor

- ☐ Driving overall leadership of the evaluation team.

- ☐ Ensure the evaluation team is staffed appropriately.
- ☐ Approve cause evaluation related documents (i.e. Charter, CE Report, Communications, etc.)
- ☐ Remove roadblocks to assist the CE team and ensure a timely and quality investigation.
- ☐ Assist in identifying and obtaining agreement from Corrective Action Owners & Additional Finding CAP Issue Owners.
- ☐ Present findings and approved CE Report at the CARB meeting.
- ☐ Remain available and request frequent check-ins with the CE team.
- ☐ Sponsor any Leadership Training Committee (LTC) and Contractor Training Committee (CTC) proposals developed as part of the corrective actions.
- ☐ Owner of the Effectiveness Review CAP, assigning actions as necessary. Confirms the criteria of the Effectiveness Review Plan were met and presents the EFFR summary report to the LOB CARB committee for approval.

Team Lead (Issue Owner)

- ☐ Manage day-to-day activities associated with the CE investigation including project schedule, charter commitments, team meetings, and assignments of tasks to team members to ensure the final report is approved on time.
- ☐ Meet with team daily for status updates, focused discussions, review, and analysis.
- ☐ Develop and approve cause evaluation related documents (i.e. Charter, CE Report, Communications, etc.)
- ☐ Active team member assisting with performing data gathering and analysis tasks.
- ☐ Remove roadblocks to assist the CE team and ensure a timely and quality investigation.
- ☐ Assist in identifying and obtaining agreement from Corrective Action owners & Additional Finding CAP Issue Owners.
- ☐ Present findings and approved CE Report at the CARB meeting.
- ☐ Verify the corrective actions are assigned and completed in CAP (if Issue Owner of the CAP).

Cause Evaluator

- ☐ Ensure adherence to the Cause Evaluation (CE) process and act as the CE process Subject Matter Expert.
- ☐ Meet with team daily for status updates, focused discussions, review, and analysis.
- ☐ Develop and approve cause evaluation related documents (i.e. Charter, CE Report, Communications, etc.)
- ☐ Active team member assisting with performing data gathering and analysis tasks.
- ☐ Assist completion of the Operating Experience and Extent of Cause analysis.
- ☐ Guide team through the identification of causes, contributing causes and associated NERC Cause Codes using the prescribed analysis tools.
- ☐ Write the cause evaluation final report and route for CE team approval.
- ☐ Submit approved CE report for ECAP Quality Review and CARB review.
- ☐ Attend CARB meeting to answer technical questions.

LOB CAP Specialist

- ☐ Active team member assisting with performing data gathering and analysis tasks.
- ☐ Meet with team daily for status updates, focused discussions, review, and analysis.

- ☐ Perform administrative tasks in CAP.
  - ☐ Attach Initial and Final Communication documents and evidence of distribution in CAP and SIF team folder.
  - ☐ Submit Extent of Condition request to EOC Review Team if required and issue EOC CAP(s).
  - ☐ Submit CAP issues for Additional Findings and Effectiveness Review (EFFR).
  - ☐ Enter causes, NERC cause codes, corrective actions, and other required attributes in CAP.
  - ☐ Verify new EFFR CAP and incident CAP are cross referenced.
- ☐ Complete Operating Experience analysis portion of the final report.
- ☐ Review Final CE Report for accuracy and completeness.
- ☐ Attend CARB meeting to answer technical questions.

Subject Matter Experts (SME)

- ☐ Key individuals recruited for their collective knowledge and experience.
- ☐ Meet with team daily for status updates, focused discussions, review and analysis.
- ☐ Active team member assisting with performing data gathering and analysis tasks.
- ☐ Contribute to the determination of causes and corrective actions.
- ☐ Provide input for initial and final communications.
- ☐ Review Final CE Report for accuracy and completeness.
- ☐ Attend CARB meeting if requested to answer technical questions.

Initial Problem Statement

Requirement, Standard, or Management Expectation:

- Utility Procedure: TD-4160P-42, "Installing Pressure-Control Fittings and Sleeves," contains guidance for the safe installation and removal of completion caps on Mueller Line Stopper Split Fittings.

Deviation or Defect:

- On 6/8/2023, while installing a completion plug during a distribution system leak repair project, the completion plug became dislodged and failed.

Consequences: (Immediate pain)

- This resulted in a release of gas and metal shavings that injured a coworker. The coworker was treated at a local hospital for injuries to the eyes and face caused by the metal shavings. The injured coworker is currently recovering at home pending additional treatment.

Significance: (Future pain)

- The failure of completion plugs to fully seat can cause gas leaks and potential injuries to workers.

SIF-Potential Apparent Cause Evaluation (ACE) Team Charter

Cause Evaluation Guidance Documents and Training Resources

- ☐ GOV-6102S, Enterprise Cause Evaluation Standard
- ☐ GOV-6102P-06, Enterprise Cause Evaluation Procedure
- ☐ GOV-6102M, Enterprise Cause Evaluation Manual
- ☐ SIF-Potential ACE Report Template
- ☐ CORP-6010 WBT, Introduction to Cause Evaluations
- ☐ CORP-6013 WBT, Cause Evaluation for Leaders
- ☐ CORP-6051 WBT, CAP Issue Management
- ☐ CORP-6011 ILT, ECAP Cause Evaluation Training (2-day)

Charter approval:

Sponsor:	Via Email	Date:	6/22/2023
CE Team Lead:	Via Email	Date:	6/22/2023
Cause Evaluator:	Via Email	Date:	6/22/2023

Note: Upload a PDF copy of the approved Charter pages to the incident CAP

SIF-Potential Apparent Cause Evaluation (ACE) Team Charter

Appendix 1

Cause Evaluation Target Schedule

Task	Start / End Date	Owner	Status
Conduct Kick-off meeting. - Team member introduction - Review roles and responsibilities (Charter) - Review deliverables and target dates (Charter) - Review team member availability - Establish progress update method and frequency with sponsor and stakeholders - Develop team daily working schedule - Discuss report development process - Provide overview cause evaluation training as needed - Provide incident de-briefing and review available information. - Develop and document the Problem Statement	Start: End:	Team Lead / Cause Evaluator	
Document qualified cause evaluator training in CAP.		Team Lead	
Develop and distribute Initial Communication to affected LoBs, and post in the Daily Digest.	Start: End: (1-week)	Sponsor / Team Lead / Cause Evaluator	
Attach the Initial Communication, LoB distribution email, and Daily Digest article to the CAP.		CAP Specialist	
Document immediate actions taken in the Draft CE report.		Cause Evaluator	
Determine Extent of Condition (EOC) and Immediate Actions - Utilize EOC analysis template to analyze risk. - If risk is identified in other LoBs, complete the EOC form located on the ECAP website and submit to EOC review committee chairperson for inclusion in the next meeting. - CE Team Lead and CE to present to the EOC committee. - Add EOC summary into final report draft if applicable. - Issue CAPs to LoB' to address EOC if required.	Start: End:	Team Lead / Cause Evaluator	

SIF-Potential Apparent Cause Evaluation (ACE) Team Charter

Task	Start / End Date	Owner	Status
Collect and organize data. - Interviews / Personnel Statements - Standards / Procedures - Incident timeline - Pictures, maps, illustrations, etc. - Contractor's evaluation report (if applicable) - Subject Matter Expert input - Any additional relevant data identified during the evaluation Note: Offer to provide a Shop Steward present at the interview for union employees.	Start: End: (1-week)	CE Team	
Determine Operating Experience and summarize results in the draft report.	Start: End:	CAP Specialist / Cause Evaluator	
Perform data analysis. - Review all data sources and document relevant facts - Barrier Analysis - HFACS - Comparative Timeline (Optional) - Factor Tree Analysis (Optional) - Fault Tree Analysis (Optional) - Missed Opportunities Matrix (Optional)	Start: End: (1-week)	Cause Evaluator	
Determine Causes and proposed Corrective Actions. - Obtain agreement with action owners and stakeholders to complete the actions including justifications for due dates.	Start: End: (7-10 days)	CE Team	
Develop and document Effectiveness Review Plan (ERP).		CE Team	
Complete the Draft Final Report.		Cause Evaluator	
Team review of the Draft Final Report and incorporate feedback.		CE Team	
Peer review of Draft Final Report by Enterprise Health & Safety or LoB Safety (Recommended). - Use Specialists who have performed SIF evaluations. - Discuss and incorporate agreed to feedback.		Cause Evaluator	
Incorporate review suggestions into the Final Report.		Cause Evaluator	
Submit new CAP issues for Additional Findings and Effectiveness Review (EFFR) and enter CAP numbers in the Final Report.		CAP Specialist	
Obtain Final Report Approvals from Sponsor, Cause Evaluator, and Issue Owner. Attach the approved Final Report and approval email(s) to CAP.		Team Lead / Cause Evaluator	
Mark the "APPV - Complete ACE Report" CAP action complete.		Team Lead	

SIF-Potential Apparent Cause Evaluation (ACE) Team Charter

Task	Start / End Date	Owner	Status
Obtain approval from ECAP Director and confirm "Complete Quality Review Sign-off" action is marked complete in CAP. - Make necessary changes to gain concurrence **(Evaluation timeline clock stops here)**	**30-Days**	Cause Evaluator	
Submit approved final report to CARB for pre-review and determine CARB presentation date.		Cause Evaluator	
Present final report at CARB meeting.		Sponsor, Team Lead, Cause Evaluator	
Implement report changes requested by CARB.		Cause Evaluator	
Obtain Final Report Approvals for revised CE report from Sponsor, Cause Evaluator, and Issue Owner. - Attach the approved Final Report and approval email(s) to CAP.		Team Lead / Cause Evaluator	
Update CAP with NERC Cause Code, Actions, Attributes, etc.		CAP Specialist	
Develop, approve, and distribute Final Communication to affected LoBs and post in the Daily Digest.		Sponsor / Team Lead / Cause Evaluator	
Attach the Final Communication, LoB distribution email, and Daily Digest (DD) article to the CAP.		CAP Specialist	

From: [redacted]
To: [redacted]
Subject: RE: ACE Charter and Problem Statement
Date: Thursday, June 22, 2023 12:41:13 PM

Classification: Internal

Hi [redacted]

While many procedures were used to complete this job, the procedure being followed at the time of the injury would have been utility procedure TD-4150P-202 " Mueller Line Stopper (M2) H-17190 and H-17191 2-Inch through 4-Inch Operation Using D-Series Drilling Machine"

Everything else looks to be in good order.

[redacted] – Region 4 Gas Distribution Superintendent
Pacific Gas & Electric | Gas OM&C
401 Work St | Salinas, California | United States
Cell [redacted]

From: [redacted]
Sent: Thursday, June 22, 2023 11:50 AM
To: [redacted]
Cc: [redacted]
Subject: ACE Charter and Problem Statement

Classification: Internal

Hello [redacted] and [redacted]

Attached is the ACE Charter for this incident, including the draft Problem Statement (included below).

If you would, please review this and let me know if additional information is needed.

Thanks,
[redacted] | PG&E | Gas CAP

Requirement, Standard, or Management Expectation:

- Utility Procedure: TD-4160P-42, "Installing Pressure-Control Fittings and Sleeves," contains guidance for the safe installation and removal of completion caps on Mueller Line Stopper Split Fittings.

Deviation or Defect:

- On 6/8/2023, while installing a completion plug during a distribution system leak

repair project, the completion plug became dislodged and failed.

Consequences: (Immediate pain)

- This resulted in a release of gas and metal shavings that injured a coworker. The coworker was treated at a local hospital for injuries to the eyes and face caused by the metal shavings. The injured coworker is currently recovering at home pending additional treatment.

Significance: (Future pain)

- The failure of completion plugs to fully seat can cause gas leaks and potential injuries to workers.