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

Incident Investigation Report

Report Date: 11/13/2014

Investigator: Nathan Sarina

Incident Number: G 20140303-01

Utility: Pacific Gas & Electric (PG&E)

Date and Time of the Incident: 3/3/2014, 11:15:00 AM

Location of the Incident: [redacted] Guadalupe Street & 3rd Avenue
Carmel-by-the-Sea, CA
County: Monterey

Summary of Incident:

On 3/3/2014 at approximately 11:15 am, a natural gas explosion destroyed a house (Service Number [redacted]) located at the Southwest corner of Guadalupe Street and 3rd Avenue in the city of Carmel-by-the-Sea (Carmel). Prior to the explosion, a Pacific Gas and Electric (PG&E) welding crew was preparing to tie-in the gas distribution main along 3rd Avenue into the newly installed plastic main on Guadalupe Street. The PG&E welding crew welded a tapping tee onto a 2-inch steel distribution main on 3rd Avenue, when the welding crew discovered that the steel distribution main had an inserted 1 ¼-inch plastic line. The inserted plastic main was damaged by the welding and tapping process which caused the natural gas to escape the plastic main. Natural gas migrated into the residential structure and later resulted in an explosion. The estimated cost of the damage is $302,000. There were no injuries or fatalities as a result of this incident. Safety and Enforcement Division's (SED) investigation found that PG&E's violations of Title 49 of the Code of Federal Regulations (49 CFR) Part 192 Sections 605(a) for failing to follow procedures to update records and 605(b)(3) for failing to provide PG&E's welding crew with accurate information, contributed to the incident. SED also found PG&E in violation of 49 CFR § 192.615(a)(7) for failing to make safe any actual or potential hazard to life or property. SED also found PG&E in violation of PU code 451. PG&E shall determine the need to provide its personnel with the equipment, tools, and materials to react to potential AOCs and emergencies that may be encountered while performing assigned tasks under 192.615(a)(4).

Casualties: None reported

Property Damage: $302,000.00

Utility Facilities involved:

Pipe Material = Plastic, Pipe Size = 1.25 (inches), MAOP = 60 (psi), Operating Pressure = 50 (psi)

Witnesses:

	Name	*Title*
1	[redacted]	Underground Construction
2	[redacted]	PG&E Journeyman Welder
3	[redacted]	PG&E Apprentice Welder
4	[redacted]	PG&E Apprentice Welder
5	[redacted]	PG&E Journeyman Welder
6	[redacted]	Canus Inspector
7	[redacted]	PG&E Foreman
8	[redacted]	Pedestrian, witness

Evidence

	Source	*Description*
1	PG&E	Intial 420 Report
2	PG&E	Data Request 4859
3	PG&E	Data Request 4775
4	PG&E	Data Request 4870
5	PG&E	Data Request 4870 Supplemental
6	PG&E	Final Form 420 Report
7	PG&E	30 Day Supplemental Report
8	PG&E	Exponent Final Report

9	PG&E	PG&E Comments Exponent Report
10	Carmel Police Department	Timeline
11	Carmel Police Department	Incident Report - Case # CG1400110
12	Monterey Fire Department	Fire Report 14-0001163
13	PG&E	Data Request 4992
14	PG&E	Data Request 5049
15	PG&E	Data Request 5143
16	PG&E	Data Request 5307
17	PG&E	Data Request 5479
18	PG&E	Data Request 5528
19	PG&E	Data Request 5581
20	PG&E	Data Request 5793

Observations and Findings:

Background

On 11/18/2013, PG&E started its Aldyl-A replacement work in the City of Carmel under Project [redacted] which includes deactivation of the existing 2-inch Aldyl-A distribution main on Guadalupe Street from Ocean Avenue to 3rd Avenue, tie-in of the newly installed 2-inch plastic distribution main, and transfer or replacement of existing services. PG&E contracted with Underground Construction to install the new 2-inch plastic distribution main and hired Canus Inspection to oversee work performed by Underground Construction. Most of the new plastic pipe installation was installed using directional boring which was subcontracted by Underground Construction to California Boring Co.

On 3/3/2014, PG&E General Construction (GC) welders were assigned to tap and tie-in the existing steel main on 3rd Avenue into the newly installed plastic main on Guadalupe Street. When the PG&E welders arrived on-site, they met with the Canus Inspector, who provided the PG&E welders with Plat [redacted] showing the gas facilities in the area. According to PG&E, the plat is maintained by the Central Coast Division Mapping Department and was provided to the Canus Inspector by the PG&E General Construction Field Engineer 1[1]. The PG&E welders were divided into two crews to work in two different locations. The first crew (Welding Crew 1) comprised of two PG&E crew members, Journeyman Welder 1 and Apprentice Welder 1. Welding Crew 1 was assigned to work in a bell hole at the intersection of 3rd Avenue and Guadalupe Street. The second crew (Welding Crew 2) comprised of two additional welders, Journeyman Welder 2 and Apprentice Welder 2. Welding Crew 2 worked further up on Guadalupe Street at another bell hole. Foreman 1 for these two crews would be performing the final tie-in between the existing steel main and the recently installed plastic main.

[1] PG&E Data Request – Index No. 4775.03

Pre-incident Construction Work

At the beginning of the job that day, the welding crews had a meeting which included a tail board briefing and a review of the job print which showed the steel main on 3rd Avenue[2]. The tailboard discussed 3 worksite hazards and 3 job specific tasks that would be performed. Plat [redacted] showed a 2-inch steel distribution main along 3rd Avenue and a 3/4-inch steel service to service number 19071[3] as shown in Figure 1. The yellow box shows approximate PG&E work area and the green box shows the location of PG&E service number [redacted].

Figure 1: Section of Plat [redacted].

Welding Crew 1 welded and tapped a save-a-valve on the 2-inch steel pipe to install a pressure gauge and to verify presence of natural gas in the steel main. The pressure gauge reading was reported at 48 psig[4] between 10:00 am and 10:15 am. Welding Crew 1 then proceeded to weld and tap into the 2-inch steel pipe using a M2 line stopper between 10:15 am and 10:35 am. During the removal of the tapping tool for the

[2] Exponent ([redacted]) interview notes on March 5, 2014 – [redacted]

[3] Service number [redacted] is the service line to the residential structure damaged by the explosion.

[4] The main has a normal operating pressure of 48 psig and a maximum allowable operating pressure (MAOP) of 52 psig.

M2 line stopper, a metal and plastic coupon were extracted. At this point, Welding Crew 1 realized that they were working on an inserted plastic main.

Emergency Response

After the extraction of the coupon, Welding Crew 1 realized that they had tapped into an inserted plastic main. Canus Inspector reported that when he returned to the site, he noticed the plastic coupon on the tapping machine and attempted first call to PG&E Central Coast Division Supervisor at 10:38 am and left a message as call was not picked up[5]. Canus Inspector was able to reach PG&E Central Coast Division Supervisor at 10:46 am. The PG&E GC welding crew did not have the tools necessary to shut off the gas[6], thus Central Coast Division Supervisor dispatched a PG&E Central Coast division crew (Division Crew) to respond to the scene. The Division Crew[7] had just finished a leak repair in Pacific Grove when they received the call from Central Coast Division Supervisor at 10:52 am and were en route by 11:07a m[8]. Canus Inspector stated that there was no smell of gas at the excavation site, but that gas could be smelled west of the bell hole at 3rd Avenue and Guadalupe Street. Pedestrian 1, a pedestrian walking by the area, stated that she noticed the gas odor before the explosion. The house exploded around 11:15 am, approximately half an hour after Welding Crew 1 realized that the inserted plastic distribution main had been breached.

After the house explosion, the first 911 call from a neighbor was recorded at 11:16 am. Canus Inspector called 911 at 11:17 am. Fire fighter engine 6415 was dispatched at 11:18 am and arrived on scene at 11:23 am. The fire department report notes that a small fire was extinguished. The fire department reports that, "*The Incident Command (IC), after conferring with PG&E supervisors, initiated an approximately 1 block evacuation zone around the explosion site because of concerns that there might be a buildup of natural gas in the area or another structure.*" Similarly, the Carmel Police report CG1400110 noted, "*During the initial assessment of the scene, PG&E requested we evacuate the residence nearby."*

The division crew arrived at 11:38 am and stopped the flow of gas at 11:45 am. The division crew stopped the flow of gas by squeezing the steel casing down around the inserted plastic main at the east and west ends of the bell hole as shown in Figure 2. Additionally, PG&E conducted a special leak survey in the aftermath with no further indication of natural gas.

[5] Exponent timeline using PG&E cell phone call history

[6] Exponent ([redacted]) interview notes March 4, 2014 – [redacted]

[7] PG&E Central Coast Division crew: [redacted] (Apprentice Fitter), [redacted] (Apprentice Fitter), and [redacted] (Fitter)

[8] PG&E Data Request Index #4992.

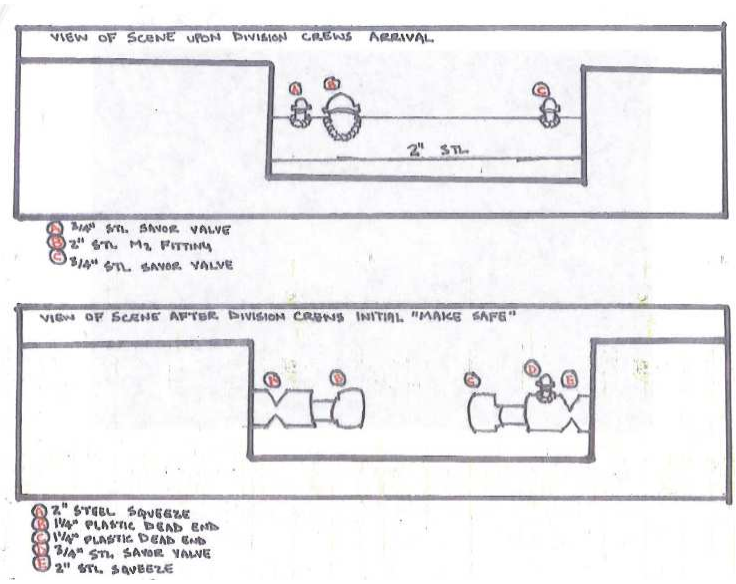

Figure 2: Sketch of how the division crew stopped the flow of gas[9]

In the event that the PG&E crew had been unable to reach the supervisor it is expected that the crew would then call their local operating clerk, who will then locate another supervisor or superintendent.

Records Review

Following the incident, PG&E conducted a record search for documents containing information about the inserted plastic main on 3rd Avenue, between Santa Rita and Guadalupe Streets. PG&E found the job package for the installation of the plastic main on Guadalupe Street, but there were no records found on the installation of the inserted plastic on 3rd Avenue. According to PG&E, the only available document containing information about the main was Plat [redacted] that was used by the PG&E GC welding crew on the day of the incident. Furthermore, the project documents issued for job [redacted] also showed 2-inch steel main as shown on Figure 3.

[9] PG&E A-form Leak [redacted]

Figure 3: Issued for construction drawing.
The red circle shows a 2-inch steel main along 3rd Avenue.

The inserted plastic on 3rd Avenue has a stamp of “071797” which indicates a manufacturing date of 7/17/1997, as shown in Figure 4. PG&E believes that the 1-¼ inch plastic main was inserted into the 2-inch steel main sometime in 1997-1998. Similarly, the service line for customer service number [redacted] 3rd Avenue and Guadalupe Street also had an inserted plastic service shown in Figure 5. However, Plat [redacted] shows a ¾-inch steel service pipe instead of an inserted ½-inch plastic service. Figure 6 shows a stamped date on the inserted service as “052697” indicating a manufacture date of May 26, 1997.

Since PG&E was not able to find any records pertaining to the plastic insert on 3rd Avenue, it is not possible to determine what part of the PG&E process failed and resulted in an inaccurate map record. It is possible that the construction crew that performed the plastic insert failed to turn in the as-built documentation to PG&E’s mapping group or that the mapping group received the documentation, but failed to update the map records. Regardless of the specific process failure, PG&E did not have a formal Quality Assurance/Quality Control (QA/QC) process in place at the time to prevent recordkeeping errors from taking place. PG&E expected that mapping leads would review a mapper’s work prior to the map being accepted.

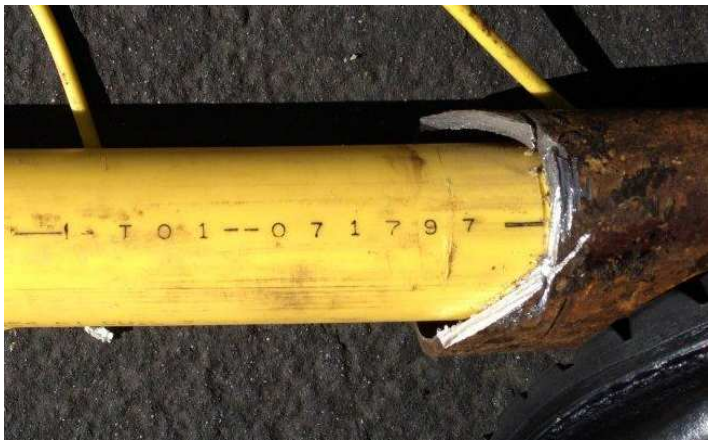

Figure 4. Date stamp on inserted plastic main indicating 071797

Figure 5: The service riser inserted with plastic.

Figure 6: Date stamp on inserted plastic for service of [redacted] indicating 052697.

Failure Analysis

In the aftermath of the incident, PG&E hired a third party company, Exponent Failure Analysis Associates (Exponent), to conduct a failure analysis investigation of the incident. Examination of the 1-1/4 inch plastic distribution main showed that the inserted plastic main was damaged in two sections during the welding and tapping process. The welding and tapping of the save-a-valve caused the smaller hole in the 1 ¼-inch plastic main. At this point, gas was flowing down the annular space between the plastic main and steel casing, as shown in Figure 7, which was why the PG&E welders reported reading 48 psig with the pressure gauge. A reading of 48 psi would not be an indicator that there existed a problem as it is close to the operating pressure of 50 psi that the main typically is at.

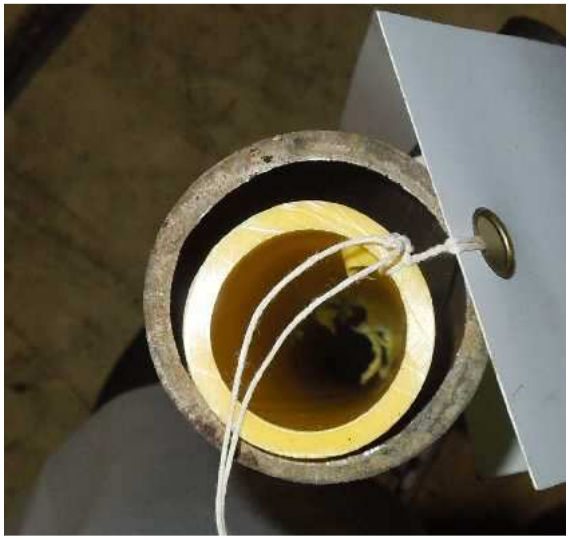

Figure 7: 1-¼ plastic main inserted into 2 inch steel.

The welding and tapping of the M2 line stopper later caused a larger hole on the inserted plastic main causing further release of natural gas from the inserted plastic main. Figure 8 shows the smaller and larger holes caused by the installation of the save-a-valve and line stopper. The larger hole on the left was caused during the installation of M2 line stopper and the smaller hole on the right was caused by the save-a-valve installation.

Figure 8: Damaged plastic main insert and steel casing showing two damaged locations.

On 3/21/2014, SED witnessed Exponent perform a gas migration test using helium to investigate the likely gas migration path. The test demonstrated that it was possible for the gas to flow through the annular space between the plastic main and steel casing, and that gas escaped from the steel casing through the break, where the customer's service line was connected to the main. The natural gas migrated into the soil downwards to the sewer lateral, and through an opening in the sewer lateral. The break in the sewer lateral provided a migration path into the house. Natural gas accumulated inside the house until it reached the explosive limit around an ignition source, suspected to be the stove pilot light.

Operator Qualification

Records of Operator Qualification (OQ) for the PG&E GC welding crew were reviewed for the covered tasks of Tapping and Plugging. Welding Crew 1, Journeyman Welder 1 and Apprentice Welder 1, were both qualified to perform tapping for the Save-A-Valve (OQ-0601) and Operating Line Stop M2 (OQ-0602). Additionally, both had the necessary welder qualifications to weld on the tapping fittings.

The material used to train the Welding Crew 1 for tapping and plugging, *Gas 0192 - Mueller Tapping and Plugging* (Gas 0192), was reviewed. PG&E's Gas 0192 lists abnormal operating conditions (AOCs) that employees must recognize and react to while performing the covered tasks. Examples of AOCs listed included uncontrolled leakage of natural gas and pipeline system damage. PG&E's Gas 0192 did not include specific responses for the AOCs. However, PG&E personnel, including the welding crew on site, are trained in PG&E's Gas Emergency Response Plan (GERP) which requires that personnel must make the area safe and contact their supervisor for any potentially hazardous situation.

Prior to the explosion, PG&E GC welding crew attempted to "make the area safe" by preventing pedestrian and vehicular traffic from entering the area. Additionally, calls were made to two different supervisors informing them of the circumstances.

Alcohol and Drug Testing

PG&E performed drug and alcohol tests on the five PG&E employees involved in the accident. Results of the tests on all five employees returned negative for drugs and alcohol. Although the tests were not performed within two hours of the accident, PG&E has noted reasonable cause for not performing the tests promptly[10]. PG&E's stated that the employees were involved in securing the site after the explosion, as well as shutting down the gas, which delayed the administration of the testing. SED finds this to be a valid reason to delay testing. The alcohol tests occurred between 14:27 and 15:03 well within the 8 hour time frame that would require PG&E to stop trying to test for alcohol. The drug testing occurred at that time as well.

Mapping Procedures

In 1997 and 1998, the applicable mapping procedure for PG&E was Mapping Standard 410.21-1. After the insertion of the plastic pipe into the main and service by field crews, a record of change is turned in to the PG&E's mapping group. Mapping Standard 410.21-1 sections, "*II. Gas Mains. 15. Insert Mains…"* and "*III. Gas Services. 9. Insert Service..."* required an update of the existing maps to reflect the conditions that existed in the field. As of 08/15/2014 PG&E has been unable to find any record of the plastic insertions that took place along 3rd Avenue in Carmel.

PG&E is currently using SAP to manage jobs. The tasks needed to complete the job are assigned out to different individuals. Within the mapping process a "Mapper" would be assigned to map the job and a "Lead Mapper" will QA/QC the map prior to being posted and used as a live document. PG&E is running quarterly reports in SAP to ensure that a different mapper is completing each task within the mapping process. PG&E currently pre-maps work prior to construction starting, allowing for an additional opportunity for review.

Post Accident Actions

PG&E implemented new safety protocols for distribution tapping work. PG&E released *5 Minute Meeting* to assist field personnel in identifying whether or not a steel pipe has been inserted with a plastic pipe. It involves a record review step, jobsite review, and a physical verification step. The jobsite review requires field inspection of the facilities to verify that the facilities in the field matches the records. The physical verification step is an additional step which utilizes existing fittings to check for presence of gas. The *Gas*

[10] Title 49 CFR 199.225(a)(2)(i) states, "If a test required by this section is not administered within 2 hours following the accident, the operator shall prepare and maintain on file a record stating the reasons the test was not promptly administered……"

Carrier Pipe Checklist was also developed and provided to field personnel to document actions required by the *5 Minute Meeting*.

In order to track the success of the Gas Carrier Pipe Checklist PG&E's distribution Quality Control team will perform assessments of gas distribution construction work across PG&E's system to ensure that field personnel are properly using the Gas Carrier Pipe Checklist, and that work is performed in accordance to PG&E standards and procedures.

On 3/21/2014, PG&E published *TD-4150P-110 – Continental Steel to PE Mechanical Bolt-On Saddle Punch Tee* to supplement the physical verification step outlined in the *5 Minute Meeting*. The purpose of the Bolt-on Saddle Punch Tee is to prevent failure of inserted plastic lines, as the Bolt-on Saddle Punch will not pierce into an inserted plastic. Additionally, in the aftermath of the incident, PG&E performed testing and determined that the heat from welding caused the plastic pipe to fail before the pipe was bored into[11]. The use of the mechanical fitting would prevent failure of an unknown inserted plastic line caused by the heat generated from the welding process.

On 6/03/2014 SED engineers witnessed a test of the Continental Steel to PE Mechanical Bolt on Saddle Punch Tee on a 1 ¼-inch plastic inserted into 2-inch steel. The test demonstrated that when tapping, the punch goes through the pipe and that there is a taper down to the punch which provides a hard stopping point for the punch. The punch pushed the plastic insert down to the bottom of the casing and lightly scored it, without breaching the plastic pipe. PG&E also presented shop testing information that showed under what conditions weld heat would cause an inserted plastic pipe to leak.

Additionally PG&E gas taken the following additional actions, some of these items will be applied system wide with others being applied to the city of Carmel specifically.

1. In addition to its distribution crews, PG&E has trained general construction employees working on gas projects in the city of Carmel on proper use of pipe squeezers. Additionally, all crews working in the city of Carmel have been equipped with the necessary emergency tools. PG&E will be expanding its training on the use of pipe squeezers and will equip all general construction employees system-wide with the necessary emergency tools.

2. PG&E requires that safety briefings be conducted prior to commencing work at a job site to review potential safety issue including emergency protocols pertinent to the specific activities performed. The Job Site Safety Analysis (JSSA) form will be modified to provide better guidance and ensure that the safety briefings are comprehensive.

[11] Data Request 5143.

3. PG&E is treating all odor calls in the city of Carmel as immediate response. This requires PG&E to immediately dispatch personnel to respond to a gas odor call in the city of Carmel. PG&E's goal for 2014 Immediate Response time is 21 minutes.

4. Coordinate with Carmel City Staff on Construction Projects. PG&E will have a designated Project Manager who will coordinate with the City of Carmel on permitting requirements and ensure that all work is performed in accordance with city requirements. A PG&E field inspector will also be assigned during construction to work closely with the City's inspector. PG&E will continue to engage the City staff throughout the construction project including but not limited to pre-construction walk through inspection, pre-construction tailboard training with PG&E crews, and regular site visits.

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

	General Order	***GO Rule***
1.	General Order 112E	49 CFR § 192.605(a)
2.	General Order 112E	49 CFR § 192.605(b)(3)
3.	General Order 112E	49 CFR § 192.615(a)(7)
4.	General Order 112E	49 CFR § 192.615(a)(4)
5.	Public Utilities Code	PU 451

Summary of Findings:

1. PG&E believes that the plastic pipe main on 3rd Avenue and the service line to the damaged house was inserted in 1997-1998. PG&E's Mapping Standard 410.21-1 in effect during this time period states in part, "*II. Gas Mains. 15. Insert Mains. When a main is installed within an old main, the original size shall follow the kind of pipe in parentheses…*" Additionally PG&E's Mapping Standard 410.21-1 states in part, "*III. Gas Services. 9. Insert Service. …when a new service is installed within an old service, the new size…old size shall be shown beneath…"*

   PG&E failed to follow Mapping Standard 410.21-1 and update records of the gas distribution system when the distribution main along 3rd Avenue in Carmel was inserted with 1 ¼-inch plastic. Similarly, PG&E failed to follow and update its records when the service line to the house damaged by the explosion was inserted with a $^{1}/_{2}$-inch plastic. Therefore, SED finds PG&E in violation of Title 49 CFR § 192.605(a) which states in part:

   "*General. Each operator shall prepare and **follow** for each pipeline, a manual of procedures for conducting operations and maintenance activities…*" [Emphasis added]

2. PG&E did not find records pertaining to the inserted plastic on the main on 3rd

Avenue. The plat provided to the contractors and PG&E welding crews contained historical information regarding the original installation of the 2-inch steel main, and did not reflect the plastic insertion work that occurred sometime in 1997-1998.

On 6/13/2002, Pipeline and Hazardous Materials Safety Administration (PHMSA) issued an Advisory Bulletin (ADB-02-03) which states in part: *"The maps or associated records should provide… (4)The **diameter**, grade, **type**, and nominal wall thickness of pipe... RSPA[12] urges every pipeline operator to ... keep these maps and records up-to-date as pipeline construction and modifications take place…"* [Emphasis added]

PG&E's failure to update its records led to the company providing incomplete information about the distribution main to its workers. Therefore, SED finds PG&E in violation of Title 49 CFR § 192.605(b) which states in part:

> "*The manual required by paragraph (a) of this section must include procedures for the following, if applicable, to provide safety during maintenance and operations ...*
> *(3)Making construction records, maps, and operating history available to appropriate operating personnel.*"

3. PG&E's Gas Emergency Response Plan (GERP) defines a gas emergency as *"An actual or potential hazardous escape of gas."* Additionally, PG&E's GERP states that "Make Safe" activities are explicitly built into the Training Aids and that actions may include restricting access to the site, eliminating ignition source, closing valves, or engaging automatic shut-off switches[13].

   After the inserted plastic main was damaged, there was an uncontrolled release of gas and the gas had an unknown migration path, representing a potentially hazardous escape of gas. PG&E GC welding crew made the immediate excavation area safe by preventing vehicular and pedestrian traffic near the excavation site. The field crew also contacted the responsible supervisors and requested for assistance to shut off the gas flow.

   On 5/16/2001, PHMSA released Advisory Bulletin (ADB-01-02) which states in part: *"Owners and operators of gas distribution systems should ensure that their emergency plans and procedures require employees who respond to gas leaks to consider the possibility of multiple leaks, to check for gas accumulation in nearby buildings, and, if necessary, to take steps to promptly stop the flow of gas."*

   PG&E's GERP Training Aid 13 – Outside Gas Leak and Odor Investigation in effect at the time of the incident requires an assessment of the situation and to check if

[12] Research and Special Programs Administration (RSPA) of the Office of Pipeline Safety

[13] PG&E GERP Volume 1, Version 3, Page 1-4 and 2-12

people are in danger and if so, to get them out of danger. PG&E's GERP did not explicitly require checking for possibility of multiple leaks or gas accumulation in nearby buildings as stated in the PHMSA Advisory Bulletin, however an assessment of the condition implies the need to evaluate the extent of the leak. Prior to the explosion, PG&E reported that although they did not smell gas at the excavation site, there was a smell of gas coming west of the site[14]. Statement from a pedestrian walking by the area also mentioned smelling gas odor prior to the explosion. However, there were no additional actions taken to further assess the extent of the gas leak. With no additional actions taken to assess the extent of the gas leak the area was not made safe against hazards to life or property.

There were further steps that PG&E could have taken that would have provided additional levels of safety. While PG&E would not have been able to determine where all the gas was migrating to, there were indications of gas odor smell west of the excavation site. An additional step could have been going door to door to the west of the excavation site and checking customers who may be home. This would have provided PG&E the opportunity to inform and warn customers of the gas leak. Additionally, local first responders such as the fire department could have been contacted to assist in notifying nearby residents of the leak, including possible evacuation, prior to the explosion. It is imperative that PG&E trains its personnel on how to apply its GERP in emergencies.

Title 49 CFR § 192.615(a)(7) states:

> *"Each operator shall establish written procedures to minimize the hazard resulting from a gas pipeline emergency. At a minimum, the procedures must provide for…(7) Making safe any actual or potential hazard to life or property."*

4. PG&E's failure to adequately equip their GC welding and OQ qualified personnel with the tools necessary to stop the uncontrolled flow of gas especially in light of their recordkeeping deficiencies, 7/30/13 Mountain View incident, 2/27/14 near miss, constitutes a violation of PU code 451. Further Subpart N of 49 CFR 192, amongst other criteria, identifies OQ personnel as those who are trained to "recognize and react to abnormal operating conditions." SED believes that reacting to such an AOC involves the utility equipping crews tapping into a live gas system with the tool necessary to "react" by promptly stopping the flow of gas and not merely cell phones.

   PU code 451 states:

[14] Exponent ([redacted]) Interview Notes – [redacted]

> *"….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.*
>
> *All rules made by public utility affecting or pertaining to its charges or service to the public shall be just and reasonable."*

Recommendations

1. Three of the PG&E GC personnel present at the incident site were qualified for squeezing steel pipe under PG&E's OQ-0203 Pipe Squeezing - Steel. Foreman 1, Journeyman Welder 1 and Journeyman Welder 2 had the training and qualifications to squeeze the steel main at the time of the incident if steel squeezers were available at the site. This would have allowed the crew already on-site to isolate the breached section at an earlier time if the equipment had been available. With the appropriate tools and training the leak could have been potentially shut off before the explosion.

   Title 49 CFR § 192.615(a)(4) states:

   > *"Each operator shall establish written procedures to minimize the hazard resulting from a gas pipeline emergency. At a minimum, the procedure must provide for… (4) The availability of personnel, equipment, tools, and materials, as needed at the scene of an emergency."*

   In light of this incident, PG&E should evaluate the effectiveness of its emergency procedures and determine the need to provide its personnel with the necessary equipment, tools, and materials to react to potential AOCs and emergencies that may be encountered while performing various tasks.

2. When examining *Gas 0192 - Mueller Tapping and Plugging* (Gas 0192), PG&E's training for tapping, the possible AOCs that personnel would need to recognize are explicitly called out. The actions needed to be taken after the recognition that an AOC exists are not explicitly called out. PG&E has stated that the actions taken by its employees after recognition of an AOC are contained within its GERP. While there is no requirement that AOCs and the responses be contained in the same document, PG&E should make clear the interplay between the recognition of AOCs and the response dictated by PG&E's GERP.
3. In light of the recordkeeping error PG&E should take additional steps that would mitigate possible recordkeeping issues. These should be actions taken to either

verify the material in the ground or testing that would confirm the accuracy of the available record.

Appendix A. Composition of Crew

Welding Crew 1: [redacted] (Journeyman Welder), [redacted] (Apprentice Welder)

Welding Crew 2: [redacted] (Journeyman Welder), [redacted] (Apprentice Welder),

Journeyman Welder 1: [redacted]

Apprentice Welder 1: [redacted]

Journeyman Welder 2: [redacted]

Apprentice Welder 2: [redacted]

Foreman 1: [redacted]

Construction Field Engineer 1: [redacted]

Canus Inspector: [redacted]

PG&E GC Supervisor: [redacted]

PG&E Central Coast Division Supervisor: [redacted]

Pedestrian 1: [redacted]

Appendix B. Timeline

Time (year/month/day):hour	Activity
1997-1998	2 inch main and ¾-inch service line inserted and is unmapped.[15]
2014/03/03:(10:00-10:15 am)	Welding Crew 1 installed and tapped a save-a-valve [15]. Gas leak begins.
2014/03/03:(10:15-10:35 am)	Welding Crew 1 installed and tapped a M/2 line stopper. [15]
2014/03/03:(10:38 am)	Canus Inspector called Central Coast Division Supervisor to report. Call was not picked up, so Canus Inspector left message.[15]
2014/03/03:(10:39-10:42 am)	Canus Inspector made calls to locate Central Coast Division Supervisor.[15]
2014/03/03:(10:46-10:49 am)	Canus Inspector spoke with Central Coast Division Supervisor. Central Coast Division Supervisor confirms that responding crew would have hydraulic squeezers.[15]
2014/03/03:(10:52 am)	Central Coast Division Supervisor contacts Gas Division crew in Pacific Grove and informs them of leak. [7, 15]
2014/03/03:(10:52-11:07 am)	Gas Division Crew stops work in Pacific Grove and leaves. [7, 15]
2014/03/03:(11:07-11:22 am)	Gas Division Crew en route.[7, 15]
2014/03/03:(11:15 am)	Explosion occurs.
2014/03/03:(11:16 am)	Canus Inspector called Central Coast Division Supervisor informing him of explosion. [15]
2014/03/03:(11:16 am)	Neighbor calls 911. [15]
2014/03/03:(11:17 am)	Canus Inspector calls 911. [15]
2014/03/03:(11:18 am)	Monterey Fire Department receives report of explosion.[16]
2014/03/03:(11:23 am)	Fire Department arrives on scene.[16]
2014/03/03:(11:25-11:40 am)	Time PG&E spent moving trucks and setting up to stop gas flow.[14]
2014/03/03:(11:25 am)	Time reported (Time PG&E was notified) on A-form (PG&E leak repair form) for Gas Division Crew.[7, 17]

[15] Data Request 5049, 5156 Timeline Update Carmel Supplemental Report

[16] Monterey Fire Department Incident 14-0001163.

[17] PG&E A-Form (leak repair form).

2014/03/03:(11:38 am)	From A-form, time of arrival of Gas Division Crew.[7,17]
2014/03/03:(11:45 am)	From A-form, Gas Flow stopped.[17]