National Transportation Safety Board

Washington, D.C. 20594

Pipeline and Operations Factual Report

A. Accident Identification

Description: Explosion and fire at private residence
Product: Natural Gas
Location: 10708 Paiute Way, Rancho Cordova, California
Date/Time: December 24, 2008, 1:35 p.m. PST
NTSB No.: DCA09FP003

B. Parties to the Investigation

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C. Accident Summary

At approximately 1:35 p.m. (PST) on December 24, 2008, an explosion and fire caused by a natural gas leak destroyed a residence at 10708 Paiute Way in Rancho Cordova, CA. One elderly person suffered fatal injuries and five other people, including one utility employee and one firefighter were hospitalized as a result of the explosion. Two adjacent homes, one on either side, had severe damage and several homes suffered minor damage. The property damage figure according to the Pacific Gas and Electric Company is $ 267,000.

FIGURE 1 – DAMAGE CAUSED BY THE EXPLOSION

D. Post-Accident Pressure Tests and Pipeline Excavation

On the day of the accident, PG&E personnel started to hand excavate the bell holes that were originally dug in 2006. They excavated to enable them to successfully squeeze off the 2-inch Aldyl-A plastic gas main pipe. The excavations were done in order to install a test header on the east end and a plug on the west end of the pipeline. Services between the cut ends of the main were secured at the time. PG&E then pressurized the gas main up to 40-psig with an inert gas. The pressure immediately dropped, which indicated that there was a leak in that section of pipeline. The service tee connection at the main was then uncovered and the section of the pipeline to the west of the tee was isolated and capped. This isolated section of the main was then pressurized to 87-psig. Pressure held in the pipe, indicating that there was no leak present in that section of pipeline. Next, the service line to 10708 Paiute Way was isolated from the gas main, and upon being pressurized to 95-psig, it held pressure, indicating that there was no leak present in the service line.

On that same day, PG&E began excavation of the gas main to the east of the service line. A backhoe was initially used to expedite the process, however as the backfill began to smell like natural gas and had a noticeable green hue, backhoe operations ceased. After this occurred, PG&E personnel proceeded to hand excavate until the gas main was exposed. Pictures and measurements of the main were then taken before it was fully uncovered or moved.

Once the main pipe was fully uncovered, PG&E proceeded to pressurize the line. Upon pressurization, the west end of the 1¼-inch coupling began excessively leaking air.

ATTACHMENT 1 - PG&E Gas Crew Foreman Interview, Section of PHMSA Rancho Cordova Field Report & Section of PG&E Rancho Cordova Data Response & California Public Service Commission Data Request Number VI

E. California Public Utilities Commission Audit

The California Public Utilities Commission (CPUC) audited PG&E in early May 2008 and found that the PG&E procedure for field service representatives to respond to gas leaks does not define the term “hazardous leak” nor does it qualify field service representatives on the use of gas detection equipment or grading leaks outdoors. “The process in Utility Operations Standard UO-6434, wherein events requiring immediate attention are identified and classified by persons not qualified to make such decisions,

has the real potential to prevent or delay qualified personnel from timely responding to, and correcting what can be, very hazardous conditions."[1]

On August 1, 2008 the CPUC sent a formal letter to PG&E listing the areas of violation found during the May 2008 audit and requested corrective action. The CPUC determined that PG&E was in violation of DOT 49 CFR Part 192 sections 192.615 (a)(3) and (a)(4) regarding emergency plans and ordered the company to review it's procedures and make certain all personnel who respond to reports of gas leaks have the proper training and equipment.

In a response letter dated November 5 to the CPUC, PG&E stated they agreed with the finding and agreed to update their UO-6434 "Gas leak and Odor Response" procedure system-wide, and define "hazardous leak", and properly train, qualify, and provide the proper equipment to the gas service representatives to grade outdoor leaks. This information was to be communicated to PG&E personnel no later than December 31, 2008 in the form of a Gas Information Bulletin.

An update was provided to the Safety Board by the California Public Utilities Commission on July 15, 2009 revealed that PG&E had not issued the Gas Information Bulletin by 12/31/2008 but PG&E has provided the gas service representatives with combustible gas indicators suitable for outdoor leak grading and qualified them on their use.
The CPUC also provided the following additional information to the Safety Board.
"In June 2009, PG&E issued a new Work Procedure 6434-01 (WP6434-01). WP 6434-01 provides improved guidance on the dispatching of personnel to an immediate response situation and it provides improved guidance on actions to be taken depending on % LEL gas levels found within, or in the immediate perimeter (i.e., around windows, doors, vents, etc.) of, a structure. However, WP 6434-01 continues to lack definitions of what constitutes a **hazardous** or **non-hazardous** leak over a gas main or service line. Although it provides one example of each condition, WP 6434-01 does not provide clear, uniform, definitions which allow a gas service representative to assess any leak found, classify it as **hazardous** or **non-hazardous**, and then take actions accordingly. Since this was the same concern that prompted the finding noted in the USRB's August 2008 Fresno Division Audit Report, we do not believe PG&E's actions have satisfactorily addressed that finding."[2]

ATTACHMENT 2 – CPUC AUDIT AND PG&E RESPONSE

[1] August 1, 2008 letter from the California Public Utilities Commission to PG&E *Notice of Violations of General Order 112E – Compliance Inspection of PG&E's Fresno Division*

[2] E-mail communication from Banu Acimis of the California Public Utilities Commission regarding update of the Sunil Shori audit letter of August 1, 2008.

F. Pipeline Information

Post-accident excavation revealed that the source of the natural gas leak occurred where a spool piece of pipe had partially pulled out of a 1¼-inch coupling. The figure #2 pictured below shows a close-up view of the excavated section of pipeline where the failure occurred. The photograph is oriented from east to west. Moving from left to right the photograph shows a portion of the original 2–inch Aldyl-A plastic main pipe, followed by a small portion of the 21-foot section of 1¼-inch yellow polyethylene pipe, a 1¼-inch coupling, a 6–inch section of 1¼-inch unmarked yellow polyethylene pipe, a 1¼-inch–by–2-inch transition fitting, and another portion of the original 2-inch Aldyl-A plastic main pipe.

FIGURE 2 –LEAK AS DISCOVERED IN THE FIELD. THE "SPOOL PIECE" IS IN THE CENTER OF THE PHOTOGRAPH AND THE LEAK IS ON THE RIGHT SIDE OF THE 1¼-INCH COUPLING.

The pipeline failure occurred at the 1¼-inch coupling. The 6-inch section of 1¼-inch yellow polyethylene pipe, which had been used to complete a repair, pulled out of the coupling on the west side. The short section of yellow pipe was unmarked.

ATTACHMENT 3 – PG&E WORK ORDER FOR SEPTEMBER 21, 2006 REPAIR

G. Previous Repairs

On September 15, 2006 a gas odor complaint was called in by the owner's of 10708 Paiute Way. PG&E dispatched a crew to evaluate the owner's complaint. The crew determined the source of the odor was coming from a leak in the 2-inch diameter

Aldyl-A plastic pipe gas main located on the owner's property (off the south side of the street). The gas main, which was originally installed in 1977, was then cut at two locations about 20 feet apart. The leak was repaired by inserting 20 feet of 1¼-inch polyethylene pipe inside the older 2-inch diameter Aldyl-A plastic pipe. The insertion was made across the leak. The main was then reconnected by installing a 2-inch to 1 ¼-inch Metfit reducing coupling to join one end of the severed 2-inch main to one end of the 1¼-inch polyethylene insert. The other end of the 1¼-inch insert was then joined by a 1¼-inch Metfit straight coupling to an approximately 6-inch long piece of 1¼ inch polyethylene pipe. This short pipe section or "spool piece" was then joined to the other severed end of the 2-inch main by a Metfit 1¼-inch to 2-inch reducing coupling. This leak repair on the gas main was completed on September 21, 2006. The pipe installed was US Poly 1¼-inch iron pipe size (IPS) polyethylene pipe installed at a working pressure of approximately 55-psig and a maximum allowable operating pressure of 60-psig.

Upon completion of the repair, PG&E pressurized the repaired section at 100-psig of air pressure for 5 minutes and with natural gas at approximately 50-psig. PG&E also soap tested for leaks.

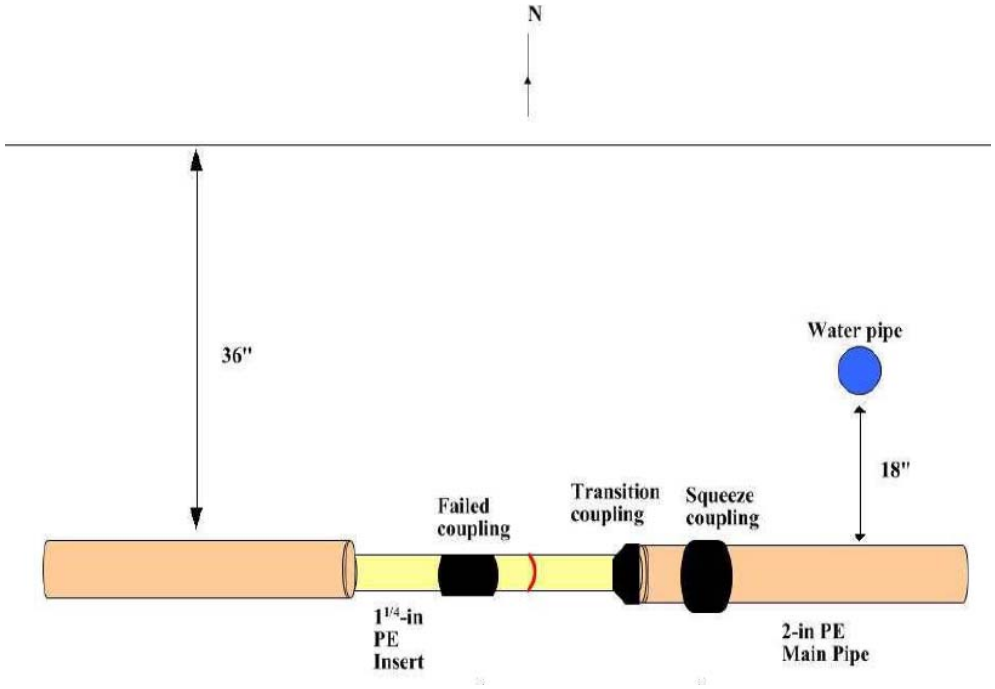

FIGURE 3 – GRAPHIC DIAGRAM OF REPAIR

H. PG&E Policy on Polyethylene Pipe Installation

PG&E informed Safety Board investigators that it is their policy to only use polyethylene pipe meeting ASTM specifications in their natural gas pipeline system. The company further stated that it had never purchased any unmarked 1¼–inch yellow polyethylene pipe. PG&E stated it ensures that the materials they use meet

ASTM specification by working only with approved polyethylene piping manufacturers, inspecting manufacturing facilities, and evaluating the resin materials used to manufacture the piping. PG&E specifications stipulate that the company will not accept pipe older than 6 months from its manufacturers.

Another measure PG&E takes to ensure that only polyethylene pipe meeting specifications is installed in its natural gas pipeline system is enforcing an internal policy, or gas standard, entitled A-93, which requires that pipe older than 3 years of its manufacture date be disposed of. Additionally, PG&E only maintains a limited inventory of materials to ensure that pipe is not held in reserve for long periods of time. Lastly, PG&E regularly inspects pipe for any physical damage, including kinks, scratches and gouges, after each handling operation.
According to PG&E, crew members are required to check pipe manufacture dates on various installation documents and reject any pipe that exceeds PG&E pipe expiration requirements. Crew members are also trained not to use outdated pipe for system installation.

Further, the unmarked 1¼-inch yellow polyethylene pipe is not used as either casing[3] or sleeves[4]. PG&E stated that the smallest casing used by the company is two inches in size and made of either PVC or steel. Sleeve manufactures contacted by investigators stated that the sleeves are both larger and marked.

ATTACHMENT 4 - 2006 Gas Crew Foreman Interview & Data Response

I. Other Repair Issues

After the accident, PG&E and the California Public Utilities Commission investigated the records of 1 ¼ inch plastic piping repair records to determine if Metfit coupling leakage or pullout had possibly been encountered elsewhere in the PG&E system and if so determine the extent.

On October 7, 2006 a 1¼-inch polyethylene pipe repaired in Sacramento, California using 4 MetFit couplings leaked and/or blew out during installation. PG&E sent sections of pipe and the 4 couplings to US Poly for evaluation by the manufacturer since PG&E initially believed the couplings were the cause of the installation failure. US Poly measured 3 of the fittings and the pipe and concluded the pipe was out of tolerance and the apparent failure cause, but since there were only partial print lines US Poly did not follow up on the report because they were not convinced it was their pipe. PG&E did not identify the sections of pipe to US Poly as their pipe, nor did US Poly ask PG&E to identify the manufacturer of the pipe. PG&E, who claims they only used US Poly pipe, checked their truck and yard stock, and all unused 1¼-inch polyethylene pipes matching the partial print line were measured and found to be within specification. PG&E felt that this was an isolated incident and as a result did not follow up with the manufacturer beyond the original contact with US Poly or

[3] Casing is installed around ASTM specification pipe for added protection.

[4] Sleeves are installed around ASTM specification pipe at pipe connection to prevent pullouts.

perform further reviews within their system. The sections of pipe and couplings that PG&E claimed were from the October 7, 2006 incident were submitted by PG&E to the Safety Board's lab for testing.

ATTACHMENT 5 – PG&E AND UPONOR RESPONSE TO OCTOBER 7, 2006 INCIDENT

J. Post-Accident Excavation of Previous Repair Work

While PG&E stated that they never purchased any unmarked 1¼-inch polyethylene pipe and only installed pipe meeting ASTM specifications in their natural gas pipeline system, the failure in this accident occurred at a 1¼–inch coupling where a small section of unmarked 1¼-inch pipe was used to complete a repair. Following the accident, PG&E was concerned that additional sections of unmarked pipe not in compliance with ASTM D-2513 may have been installed in their natural gas pipeline system. The company decided that it would be prudent to determine if other sections of recently repaired or replaced, unmarked and non-compliant 1¼-inch yellow polyethylene pipe pipe (with adjoining couplings) had been installed in its system. Thus they proceeded with excavations of sections of the 1¼–inch polyethylene pipe and attached couplings.

PG&E documents stated that a total of sixteen post-accident California excavations were completed at 1 ¼-inch PE pipe repair sites. The excavations turned up no non-compliance with ASTM D-2513 standards unmarked PE pipe.

The first two excavations were completed on the consecutive days of February 11 and 12. These two excavations were done on Consumnues River Boulevard[5] and Pell Drive[6] in Sacramento. The next excavation was done in Elk Grove, CA[7] on March 16. Excavations were then completed on consecutive days from March 18 through March 21 in Fair Oaks,[8] Rio Linda,[9] Orangevale,[10] and Sacramento.[11]. Two other excavations were done in March (24 & 26). The excavations were completed in Vacaville[12] and Citrus Heights.[13] On April 1, three excavations were completed, one in Elk Grove,[14] and two in Sacramento.[15] One Sacramento excavation was done on April 2[16] and two more Sacramento excavations were completed on the day

[5] 8101 Consumnues River Blvd.

[6] 4791 Pell Drive

[7] 9759 Tralee Way

[8] 8819 Bluff Lane

[9] 211 Berry Oak Court

[10] 8901 Greenback Lane

[11] 3825 Sutterville Road.

[12] 625 Yew Court

[13] 5669 Spyglass Lane

[14] 9351 Feickert Drive

[15] 3835 Freeport Boulevard and at the intersection of 24th Street and Sutterville Road

[16] 6830 Stockton Boulevard

following, April 3. The two excavations were at Auburn Boulevard[17] and the Southwest corner of Hilltop Drive and Cash Court. The next and last excavation was done on April 10th in Fairfield.[18]

ATTACHMENT 6 - PHMSA Draft Field Report Section & Data Response & CAPUC Data Request)

K. Packing Pipe

Depending on the quantity of polyethylene pipe being packed for shipment, US Poly will sometimes use unmarked polyethylene pipe lengths as part of the packing material. The pipe used for packaging is made from the same resin and on the same equipment as their specification pipe products. However the packing pipe has no print line markings and may vary greatly in dimensions from specification pipe. This packing pipe is not intended for use as a specification pipe product.

On February 19, 2009, PG&E and California Public Utilities Commission Party representatives jointly inspected the PG&E yard in Sacramento as part of this continuing investigation. They found two approximately 6-foot long pieces of 1¼-inch polyethylene pipe that had no print line marking in a bin marked "Stub Markers Only". PG&E sent the pipes to the NTSB laboratory for examination and testing; one of the two pipes had a wall thickness thinner than the minimum wall thickness required for ASTM D-2513 SDR 10 PE pipe and no print line or indentation were observed on two sections submitted.

PG&E stated that they have a sole source contract in place with US Poly and thus any polyethylene gas piping received would have been from them. The pipe is shipped to PG&E's main warehouse facilities where it is inspected and then distributed to PG&E facilities throughout the service territory. On February 24, 2009 PG&E conducted a search of its warehouse facility in Fremont to further investigate the source of the unmarked pipe found in Sacramento. The Party representative found pallets of coiled 1 ¼ inch polyethylene pipe manufactured by US Poly. The pallets contained four sticks of unmarked polyethylene pipe on the corners of the pallet apparently used to support the coils. PG&E sent several of these unmarked stick pipe found in the inspection.

There was no PG&E policy or practice in place at the time of the accident that provided direction on the use of packing pipe. PG&E determined that Sacramento yard had an informal practice of using packing pipe as stub markers. The packing pipe was stored in separate bins for stub markers. During PG&E's investigation it was in one of these bins that two pieces of unmarked 1¼-inch polyethylene pipe was found. Neither piece had a print line marking. PG&E confirmed that no other PG&E yard used the packing pipe for any purpose.

[17] 3910 Auburn Boulevard

[18] 4770Canyon Hill Drive

ATTACHMENT 7 – JM EAGLE LETTER DATED MAY 12, 2009
ATTACHMENT 8 – CPUC MEMO
ATTACHMENT 9 – PG&E PACKING PIPE RESPONSE LETTER

L. PG&E Process Improvement Initiatives

Since the time of the December 24, 2008 accident, PG&E has taken a number of process improvement initiatives. The following is a summary of these efforts:

- Field service representatives have been trained, qualified and given the necessary flame pack equipment (Combustible Gas Indicator) as well as the indoor natural gas detectors they previously carried to conduct outdoor leak investigations and to grade outdoor leaks.
- The term "hazardous leak" is now more specifically defined in PG&E Operating Instructions and two examples of leaks that would qualify as hazardous leaks are listed in the written instructions.
- A prescriptive written evacuation policy has been established and utilizes the expertise of the fire department and first responders.
- Packing pipe is explicitly prohibited from any use and must be discarded.
- If gas above 1% is found indoors, the structure needs to be evacuated and dispatch needs to be contacted to request 911 assistance.
- Field service representatives carry warning tape that they can use to cover entrances in an effort to warn homeowners not to enter the premises during leak investigations if PG&E was unable to gain access during an investigation.
- Written requirements have been established to check the wall thickness, outside diameter and print line on all plastic pipes before installation to be certain that the mechanical fittings are compatible with the pipe.
- Heat fusion saddle installation procedures are no longer used for 1¼-inch polyethylene pipe as a precaution against the possibility that the wall thickness of a previously installed polyethylene could be too thin to safely saddle fuse.
- Written requirements that all incoming plastic pipe be checked for dimensions with the national and/or PG&E Specification Standards by PG&E quality assurance personnel has been established; and that non-conforming materials be returned to the vendor or scrapped

ATTACHMENT 10 – PG&E CORRECTIVE ACTIONS

Karl Gunther
Investigator-in-Charge

ATTACHMENTS

ATTACHMENT 1 – PG&E GAS CREW FOREMAN INTERVIEW, SECTION OF PHMSA RANCHO CORDOVA FIELD REPORT & SECTION OF PG&E RANCHO CORDOVA DATA RESPONSE & CAPUC DATA REQUEST NUMBER IV
ATTACHMENT 2 – CPUC AUDIT AND PG&E RESPONSE
ATTACHMENT 3 – PG&E WORK ORDER FOR SEPTEMBER 21, 2006 REPAIR
ATTACHMENT 4 – 2006 GAS CREW FOREMAN INTERVIEW & DATA RESPONSE
ATTACHMENT 5 – PG&E AND UPONOR RESPONSE TO OCTOBER 7, 2006
ATTACHMENT 6– PHMSA DRAFT FIELD REPORT SECTION & DATA RESPONSE & CAPUC REQUEST
ATTACHMENT 7–JM EAGLE LETTER OF MAY 12, 2009
ATTACHMENT 8 –CPUC MEMO
ATTACHMENT 9 –PG&E PACKING PIPE RESPONSE LETTER
ATTACHMENT 10 –PG&E CORRECTIVE ACTIONS