Missouri Public Service Commission

Gas Incident Report

City Utilities of Springfield
Case No. GS-2003-0129

1904 E. Burntwood Street
Springfield, Missouri
September 25, 2002

Gas Safety/Engineering Section … Energy Department ... Utility Operations Division
February 2003… Jefferson City, Missouri

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SYNOPSIS

At approximately 3:30 p.m., Central Daylight Saving Time (CDST, all times in this report are Central Daylight Saving Time) on Wednesday, September 25, 2002, a natural gas ignition and fire occurred in an excavation in front of 1904 E. Burntwood Street in Springfield, Missouri. There was damage to the natural gas and water main and appurtenances, to the natural gas and water service lines to 1910 E. Burntwood Street, to two large trees near the excavation, and surrounding grass as a result of the ignition and fire. Four Water Department employees for City Utilities of Springfield (City Utilities or City) were working in the excavation when the natural gas fire occurred. As a result of the fire, one of the Water Department employees received third degree burns to his right arm and wrist, and was transported to a nearby hospital where he was admitted for treatment. The other three Water Department employees were able to escape from the excavation without injury.

City Utilities of Springfield provides natural gas service in Springfield, Missouri. The 1900 block of E. Burntwood Street is supplied natural gas through a 3-inch diameter, polyethylene (PE) main installed parallel to and along the south side of E. Burntwood Street. The residence at 1910 E. Burntwood Street was supplied natural gas through a direct-buried, ¾-inch diameter PE service line. City Utilities records indicated that the natural gas main and service line were operating at approximately 56 pounds per square inch gauge (psig) at the time of the natural gas ignition and fire.

The Missouri Public Service Commission's Energy Department - Gas Safety/Engineering Staff (Staff) has determined that the probable cause of the incident was the escape of natural gas from a damaged portion of the ¾-inch diameter PE service line that served 1910 E. Burntwood Street, which was located in the excavation in front of 1904 E. Burntwood Street.

The ¾-inch diameter, natural gas PE service line serving 1910 E. Burntwood Street was exposed by the Water Department crew during the replacement of water lines, and damaged. The Water Department personnel damaged the natural gas service line during the process of using a propane torch to heat-bend the 1-inch diameter, polyvinyl chloride (PVC) water service line to 1910 E. Burntwood Street.

The probable cause of the damage to the ¾-inch diameter, natural gas PE service line was a direct result of the construction work performed on September 25, 2002, by the City Utilities Water Department crew. During September 25, 2002, the Water Department crew was in the

process of relocating a "blow-off" on the end of the water main on E. Burntwood Street. As part of this project the water service connection for 1910 E. Burntwood Street was being moved to the west and this service line was being re-connected to the existing street crossing. The damage to the ¾-inch diameter, PE natural gas service line most likely occurred while a Water Department employee was operating a propane torch in close proximity to the natural gas service line and heat from the propane torch caused the surface temperature of the PE service line to reach the melting point of the PE material, which softened the wall of the PE pipe. Natural gas under a pressure of approximately 56 psig then escaped through the weakened wall of the PE service line and was most likely ignited by the propane torch.

During the Staff's investigation of the incident, no probable violations of Missouri Public Service Commission (MoPSC or Commission) pipeline safety regulations were found that could have contributed to the incident.

The Staff is making several recommendations to City Utilities as a result of this investigation.

Note: *City Utilities of Springfield is a municipality and as such is made up of several departments, which include a Gas Department and a Water Department. In this incident, Water Department employees were directly involved with the damage to the natural gas service line and subsequent fire. Only the City Utilities natural gas system and Gas Department employees are under the jurisdiction of the MoPSC pipeline safety regulations. For purposes of clarity in this report, the Water Department employees will be referred to as such, but the Water and Gas Departments both are entities of City Utilities.*

FACTS

NOTE: Except for the information gathered during the on-site investigation and/or interviews, the information used to compile this portion of the report was obtained in record and/or statement form.

The Incident

At approximately 3:30 p.m., CDST on Wednesday, September 25, 2002, a natural gas ignition and subsequent fire occurred in an excavation in front of 1904 E. Burntwood Street in Springfield, Missouri.

Personal Injuries

Four City Utilities Water Department employees were working in the excavation when the natural gas fire occurred. One of the Water Department employees received third degree burns to his right arm and wrist, and lesser burns to his face and ears. He was transported by ambulance to the St. John's Medical Center Burn Unit in Springfield, Missouri where he remained for treatment and skin grafting. The other three Water Department employees escaped from the excavation without injury. One of the responding fire departments evacuated four residences in the vicinity of the fire, however no other injuries were reported.

Property Damage

The resulting fire damaged water and natural gas[1] facilities in the excavation, and cable TV and electric facilities above the excavation. Also damaged by the fire, were trees near the excavation in the front yard of 1904 E. Burntwood Street. City Utilities calculated the total damages to be $24,979.10.[2]

[1] Damage to the natural gas facilities includes the following costs: response to the incident; repairs of facilities; relighting of customers, and lost natural gas.

[2] Information obtained from the RSPA F 7100.1 Federal Incident Report form submitted by City Utilities to the Staff.

Site Description

The excavation in which the natural gas ignition and fire occurred was located in front of 1904 E. Burntwood Street in Springfield, Missouri. Burntwood Street runs in a direction that is approximately a west/east direction between Stewart Avenue and Bannister Avenue and is located in the far north part of Springfield, Missouri just north of Interstate Highway 44 (See Appendix A-1, Figure 1). For purposes of this report, all geographical locations will be referenced as if E. Burntwood Street was oriented in a west/east direction. The area immediately surrounding 1904 E. Burntwood Street is a residential area consisting predominately of single-family residences.

The excavation itself was located immediately south of the south curb of E. Burntwood Street (See Appendix A-3, Figure 3-B). The excavation was approximately 20 feet long and 6 feet wide and was approximately 4½ feet in depth. The excavation contained the following: exposed sections of 3-inch diameter, polyethylene (PE) natural gas main and 8-inch diameter, polyvinyl chloride (PVC) water main, exposed sections of ¾-inch diameter, PE natural gas service line and 1-inch diameter PVC water service line, and segments of burn damaged plastic natural gas and water main and service line piping.

Meteorological Data and Conditions

The Midwestern Climate Center reported the following conditions for the weather reporting station located at the Springfield/Branson Regional Airport, located approximately 10 miles west of 1904 E. Burntwood Street. On September 25, 2002, a high temperature of 82.4 degrees Fahrenheit (ºF), a low of temperature of 51.8º F and a mean temperature of 67.1º F was recorded, with no precipitation occurring for that day. The hourly reporting condition for 3:30 p.m. on that same day, indicated a temperature of 82.4° F, 21 percent (%) relative humidity, a barometric pressure of 30.01 inches of mercury, and a wind speed of approximately 10 miles per hour from the south southwest.

Natural Gas System

Natural gas in Springfield, Missouri is provided by City Utilities of Springfield. At the time of the ignition and subsequent fire, the 1900 block of E. Burntwood Street was supplied natural gas

by a 3-inch diameter, high pressure[3], PE main. The natural gas main in front of 1904 E. Burntwood Street is located parallel to and 5 feet south of the south curb line of E. Burntwood Street (See Appendix A-2, Figure 2), and was installed by City Utilities in 1979 at a depth of approximately 40 inches, in a joint trench with an 8-inch diameter, PVC water main. There was approximately one foot of separation between the natural gas and water mains, with the natural gas main situated one foot above and one foot north of the water main. At the time of the fire, the 3-inch diameter, PE natural gas main in front of 1904 E. Burntwood Street was operating at a pressure of approximately 56 psig as indicated by the nearest telemeter[4] located at Kearney and Packer Roads. The maximum allowable operating pressure[5] (MAOP) for this PE main segment was 60 psig.

The natural gas service line serving 1910 E. Burntwood Street consisted of a ¾-inch diameter, PE pipe that was installed by City Utilities in July of 1992. The 1-inch diameter, PVC water service line that served 1910 E. Burntwood Street was installed with the natural gas service line in a single "mole" hole[6] approximately 34 inches below the top of the curb of and extending north under E. Burntwood Street (See Appendix A-3, Figure 3-B).

City Utilities Joint Trench Procedures

Installation of Natural Gas Main and Water Main and Attached Service Lines

As mentioned in the **Natural Gas System** section of this report, the natural gas main in the 1900 block of E. Burntwood Street was installed in a common trench with the water main. The joint trench procedures stipulate all requirements for the placement of natural gas facilities in a joint trench with potable water facilities. In these procedures, all joint trench facilities, natural gas and water, are to be installed by City Utilities personnel or City Utilities contractor. SM&P Utility Resources Incorporated (SM&P) is a contract locating company, which locates all such joint trench facilities and all of City Utilities underground facilities.

[3] City Utilities defines "high pressure" as operating pressures from 30 psi up to and including 60 psig.

[4] An electronic device that continuously measures the natural gas pressure in a given pressure district and continuously transmits the pressure to a systems control location.

[5] MoPSC regulation 4 CSR 240-40.030(1)(B)16., defines the "maximum allowable operating pressure (MAOP)" as the maximum pressure at which a pipeline or segment of a pipeline may be operated.

[6] A lateral hole made by a pneumatic device underground for the insertion of utility lines so as not to disturb aboveground street pavement, sidewalks, etc.

The Water Main Replacement Project in Front of 1904 E. Burntwood Street

City Utilities had received a call from the resident at 1904 E. Burntwood Street on August 18, 2002, reporting a water leak in their front yard in the vicinity of the water "blow-off" standpipe. To facilitate the repair, the City Utilities Water Department personnel decided to eliminate the section of piping and fittings at the site of the leak. This process involved relocating the "blow-off" on the end of the water main in front of 1904 E. Burntwood Street approximately 10 feet to the west. As part of this process, a new section of PVC water service line and water tap for 1910 E. Burntwood Street was installed west of the new "blow-off" location. The existing water service line for 1910 E. Burntwood Street was then heat-bended and was to be connected to the new PVC water service line and tap.

Previous City Utilities Actions

City Utilities Damage Prevention Program

As part of City Utilities damage prevention program[7], it is a member of the Missouri One-Call System, Inc.[8] (MOCS). City Utilities and their contract locator (SM&P) receive facility locate requests simultaneously from MOCS when an excavation is planned. If City Utilities has facilities in the area of the proposed excavation site, a contract field locator marks the location of the facilities at the site. At the time of the incident, City Utilities maintained records of its actions and their contract locator's actions pursuant to facility locate requests. This documentation included the original locate request, and limited information regarding the specific facilities located and/or meetings with the Water Department, and the date of City Utilities or their contract locator's response.[9]

[7] MoPSC regulation 4 CSR 240-40.030(12)(I)1. states that each operator of a buried pipeline shall carry out a written program to prevent damage to that pipeline by excavation activities. Excavation activities include excavation, blasting, boring, tunneling, backfilling, the removal of aboveground structures by either explosive or mechanical means, or other earth moving operations.

[8] The Missouri Underground Facility Safety and Damage Prevention Statute, RSMo Chapter 319, provides for a notification center to be used by participating utilities to receive locate requests. The Missouri One Call System, Inc. operates as a non-profit Missouri corporation and is the notification center providing a single-point of contact for notification of excavation activities to its members through a state-wide toll-free telephone number.

[9] MoPSC regulation 4 CSR 240-40.030(12)(I)2.E.(II) states that copies of notifications of planned excavation activities must be retained for 2 years. At a minimum, these records should include the date of the time of the request was received, the actions taken pursuant to the request, and when the response actions were taken.

Also, included in City Utilities damage prevention program is a description of procedures for evaluating excavation notifications to determine the need for inspections.[10] Activity, such as, open flames and heating devices around natural gas facilities would be considered. All City Utilities in-house departments are educated on One-Call procedures by their One-Call coordinators. This education would have included the Water Department employees.

City Utilities Response to Facility Locate Request

On September 23, 2002, the City Utilities Water Department contacted MOCS to request facility locates at 1904 E. Burntwood Street in Springfield, Missouri. The locate ticket in-turn was transmitted to City Utilities contract locater SM&P on September 23, 2002. The locate request indicated that the type of work would be "replace water main leak" at a depth of 5 feet. The locate request also stated that a backhoe would be used to excavate for the water main leak repair. The locate was completed by City Utilities contract locating company, SM&P, on Tuesday, September 25, 2002.

The City Utilities Gas Department did not conduct any on-site inspections of the excavation work performed by the Water Department crew on September 25, 2002, because City Utilities did not consider the natural gas facilities in the area as a facility that would need on-site inspections.

Leakage Surveys and Leaks

On September 6, 2000, City Utilities conducted the most recent walking leak survey[11], using a hand-held leak detection instrument, over the 3-inch diameter, PE natural gas main and service lines, which serve the 1800 and 1900 block of E. Burntwood Street. This leakage survey

[10] MoPSC regulation 4 CSR 240-40.030(12)(I)3. states that locate requests received by the operator should be evaluated to determine the need for and the extent of inspections. The following factors should be considered in determining the need for and extent of those inspections:

A. The type and duration of the excavation activity involved;
B. The proximity to the operator's facilities;
C. The type of excavating equipment involved;
D. The importance of the operator's facilities;
E. The type of area in which the excavation activity is being performed;
F. The potential for serious incident should damage occur;
G. The prior history of the excavator with the operator; and
H. The potential for damage occurring, which may not be easily recognized by the excavator.

[11] MoPSC regulation 4 CSR 240-40.030(13)(M)2.B., requires leakage surveys to be conducted outside principal business districts using a leak detection instrument at intervals not exceeding 39 months, but at least once each third calendar year for all pipelines other than unprotected steel pipelines and yardlines.

included the ¾-inch diameter, PE natural gas service line serving 1910 E. Burntwood Street. One belowground leak was detected during the leakage survey and was repaired on September 11, 2000.

City Utilities records indicate that no active leaks existed within a two-block radius of 1904 E. Burntwood Street at the time of the incident. Also, there were no natural gas leaks detected within a one-block radius of 1904 E. Burntwood Street during the 6-month period prior to the incident. However, one belowground leak on the main in front of 1900 E. Burntwood Street was repaired on September 11, 2000.

Odorization Records

City Utilities monthly odorant concentration tests conducted at a nearby test point, located near the incident site, indicated that the natural gas was adequately odorized and readily detectable at a concentration of 0.20 percent (%) gas-in-air.[12] This odorant test point is located approximately 2000 feet northeast of the incident site and the odorant readings covered the period from March 1, 2002 through September 16, 2002.

City Utilities Notification, Actions and Observations

Initial Notification and Response

City Utilities radio base stations received a radio call from the Water Department crew at 3:33 p.m. on Wednesday, September 25, 2002, indicating a "possible gas explosion". The address was reported as 1900 E. Burntwood Street. Various Gas Department emergency crews, including pressure control, gas construction, gas leak investigation, and various City Utilities Gas Department supervisors, were dispatched and began arriving at the incident site at approximately 3:40 p.m. In addition, a county fire department, assisted by a second county fire department were dispatched and arrived at the incident site at approximately 3:37 p.m. The fire departments had already begun to evacuate the houses around the incident site.

Upon arrival at the incident site, City Utilities Gas Department Personnel reported that a fire was burning in the front yard of 1904 E. Burntwood Street by the edge of the street (See Appendix B-

[12] MoPSC regulation 4 CSR 240-40.030(12)(P)1., requires the odorant in natural gas to be readily detectable at a concentration of less than 0.90% gas-in-air, based upon a lower explosive limit at 4.5% gas-in-air.

1, Photographs 1 and 2). At approximately 3:45 p.m., a Gas Department leak investigator began to leak survey in the immediate area of the incident site to check for any migrating natural gas using a hand-held flame ionization (FI) leak detection instrument[13] to sample the atmosphere above the ground and over existing natural gas mains and service lines. No gas was detected during this initial leak investigation. City Utilities Gas Department personnel determined, that, in order to stop the flow of natural gas, a valve located at the southeast corner of Stewart Avenue and E. Burntwood Street (See Appendix A-2, Figure 2) would need to be shut off. The Pressure and Control crew could not locate this valve to access it, so a decision was made to squeeze-off[14] the main at a safe distance from the incident site to stop the flow of natural gas from the damaged pipe. At approximately 3:50 p.m., the Gas Department crew began excavating over the natural gas main, west of the incident site, in front of 1832 E. Burntwood Street to install a squeeze-off tool (See Appendix A-2, Figure 2). The excavation was completed and the main was squeezed-off at approximately 4:13 p.m. The "squeeze-off" of the main terminated the flow of escaping natural gas at the incident site and also caused approximately 32 customers along E. Burntwood Street, N. Dysart Avenue, and N. Bannister Avenue, to be without natural gas service (See Appendix A-2, Figure 2). Terminating the flow of natural gas effectively extinguished the natural gas fire at the incident site, and the remaining burning debris [natural gas and water piping and appurtenances in the excavation (See Appendix B-2, Photograph 3)] was then extinguished by the responding fire departments.

During the time that preparation and squeeze-off of the damaged PE main was being completed, other City Utilities personnel were checking adjacent structures for natural gas. No gas was detected during these investigations.

To ensure the required concentration of odorant was in the natural gas, from approximately 5:25 p.m. through 5:52 p.m. on September 25, 2002, City Gas Department personnel performed odorant intensity tests at 3991 N. Stewart Avenue, 1847 E. Woodbine Street, and 1839 E. Wheatridge Drive, which are all located within one block of the incident site. The tests were conducted using an odorometer, and the natural gas was readily detectable at concentrations of 0.15%, 0.10%, and 0.10% gas-in-air, respectively.

[13] An FI unit is a leak detection instrument used to measure gas concentrations, in parts per million in an air sample. The FI unit has a built-in pump, which is able to draw in an air sample above the ground.

[14] A process where a vise-like device is installed over the main and the device is used to squeeze the plastic together so that the flow of natural gas can be restricted.

Other City Utilities Actions

Repair of Damaged Natural Gas Facilities

As mentioned in the **Synopsis and Property Damage** sections of this report, natural gas piping and fittings in the excavation in front of 1904 E. Burntwood Street were either destroyed or severely damaged as a result of the fire. Repair of these destroyed and damaged natural gas facilities was initiated at approximately 5:00 p.m. on September 25, 2002. The repairs to the natural gas facilities were completed at approximately 6:45 p.m. the same day. Upon completion of the repairs to the natural gas facilities and restoration of the flow of natural gas to the affected area, at approximately 7:15 p.m., City Utilities Gas Department personnel proceeded to conduct another leak survey of the area, obtain additional odorant intensity tests, and relight all of the affected customers.

Post Incident Leak Survey

This leak survey began at approximately 7:15 p.m. on September 25, 2002 and was completed at approximately 8:15 p.m. the same day. The leak survey area included the mains and service lines along E. Burntwood Street, between Stewart Avenue and the east end of E. Burntwood Street, Dysart Avenue, between Woodbine Street and E. Burntwood Street, and Bannister Avenue, between E. Burntwood Street and the north end of Bannister Avenue (See Appendix A-2, Figure 2). Four Class 3 aboveground leaks[15] were found during this leak survey and were scheduled for repair. No underground leaks were detected.

At 8:30 a.m. on September 26, 2002, an additional leak survey was conducted in the same area as noted in the preceding paragraph. No additional leaks were detected during this survey.

Further Odorant Intensity Tests

At approximately 7:54 p.m. to 8:25 p.m. on September 25, 2002, additional odorant intensity tests were obtained in the incident area at 3971 N. Bannister Avenue, 1904 E. Burntwood Street, 1832 E. Burntwood Street, and 3980 N. Dysart Avenue. The odorant tests indicated that the natural gas was readily detectable at concentrations of 0.10%, 0.10%, 0.10%, and 0.125% gas-in-air, respectively.

[15] MoPSC regulation 4 CSR 240-40.030(14)(C)3., defines a Class 3 leak as a leak that does not constitute a hazard to property or to the general public, but is of a nature requiring routing actions. These leaks must be repaired within 5 years and be rechecked twice per calendar year, not to exceed 6½ months.

Restoration of Natural Gas Service to Affected Customers

Restoration of natural gas service and relight of individual customers began at approximately 7:15 p.m. on September 25, 2002 and was completed for most customers by 8:30 p.m. that same evening.

MoPSC Reporting Requirements

The Missouri Public Service Commission incident reporting requirements were completed as follows:

1. The initial telephone notification of a possible natural gas incident was made to the Staff's answering service at 3:47 p.m. on September 25, 2002.[16]

2. City Utilities Gas Department personnel made a telephonic notification to the United States Department of Transportation (US-D.O.T.) of a natural gas incident at 4:45 p.m. on September 25, 2002. This incident did meet the US-D.O.T. Federal Incident reporting requirements because there was a release of gas from a pipeline that resulted in a personal injury necessitating in-patient hospitalization.

3. US-D.O.T. form RSPA F 7100.1, as completed by City Utilities Gas Department, was transmitted to the MoPSC on October 23, 2002. The Staff forwarded the report to the US-D.O.T. on November 4, 2002.

Commission Staff Actions and Investigation

Notification of Staff by the Company

As noted in the previous section of this report, the Staff's answering service was notified at 3:47 p.m. on September 25, 2002, and a Staff member was then contacted by the answering service at 4:00 p.m. that same afternoon. At the direction of the Assistant Manager Gas Safety/Engineering, two members of the Commission's Energy Department - Gas

[16] The Staff utilizes the services of an answering service, which can be contacted any time day or night to report an incident. A contact with the answering service is considered the time of notification. The answering service is normally used after regular Staff working hours.

Safety/Engineering (Staff) departed from Jefferson City at approximately 6:15 p.m. on September 25, 2002, and arrived at the incident site in Springfield at approximately 8:30 p.m. that same evening.

The Incident Site

Upon arrival at the incident site, the Staff observed numerous City Utilities and other personnel performing various activities. The Staff also observed City Utilities Gas Department personnel involved with various leak investigation procedures. Water Department personnel were also still on-site involved in various activities. The Staff was able to make contact with City Utilities Director of Gas Engineering and Gas Compliance Administrator who presented the Staff with a description of the events that had occurred and the actions taken to that point. The Staff was also apprised of the City Utilities Water Department employee's injuries.

Examination of Excavation and Surrounding Area

It was dark at the incident site and flashlights and portable work lights were used to make preliminary observations at the excavation where the fire occurred. The Staff observed an excavation in the front yard of 1904 E. Burntwood Street adjacent to the south curb of E. Burntwood Street. The Staff photographed the excavation and made preliminary sketches of the excavation and its contents. The excavation was approximately 20 feet long, 6 feet wide, and 4½ feet deep. Located in the bottom of the excavation were burned and melted plastic water main piping and appurtenances. The excavation also contained newly installed PE natural gas piping (See Appendix B-2, Photograph 4). This piping had been installed to replace piping and fittings that had been destroyed by the fire. The Staff also observed that approximately 16 feet of the back of the curb at the top of the north side of the excavation and on the south side of E. Burntwood Street exhibited signs of spalling.[17]

Several segments of 3-inch diameter and ¾-inch diameter, PE natural gas piping were laying on the ground just south of the excavation (See Appendix B-3, Photograph 5). Some of this piping was burned, melted, and scorched and some of the piping was undamaged. The piping had been removed from the excavation by City Utilities Gas Department personnel and was later transported to the City Utilities Calhoun office for safe keeping and testing. The Staff also observed other tools and equipment, which had been utilized by the Water Department crew and Gas Department crew, on the ground beside the excavation. Among these tools and equipment

[17] Spalling is the breakdown in surface tensile strength of concrete, masonry, or brick caused by exposure to high temperatures and rates of heating. Spalling is characterized by chipping or pitting of the concrete surfaces.

was a 20-pound propane tank that was burned and scorched on one side (See Appendix B-3, Photograph 6). This propane tank had been used by the Water Department crew to provide the fuel for the heating torch to heat-bend the PVC water line.

Due to darkness and the fact that City Utilities personnel had made the area safe, the Staff suspended their investigation and made plans to meet the next morning at the City Utilities Calhoun office prior to returning to the incident site. The Staff left the incident site at approximately 10:45 p.m. on September 25, 2002. Water Department crews remained at the site to complete the installation of new water piping and "blow-off" fittings that had been destroyed and damaged in the fire.

Staff Investigation - September 26, 2002

Upon arrival at the City Utilities Calhoun office the following morning, at approximately 7:00 a.m., September 26, 2002, the Staff met with City Utilities personnel in one of the building workrooms. The natural gas piping and propane tank that had been removed from the excavation by City Utilities Gas Department personnel the previous night, were located in this room. The Staff arranged the piping in the approximate position it would have been positioned in the excavation prior to the incident, and photographed and measured the piping (See Appendix B-4, Photograph 7). The Staff noted that some of the piping had been totally consumed in the fire. Upon completing the examination and photographing of the natural gas piping, the Staff made plans to return to the incident site along with City Utilities personnel.

The Staff arrived at the incident site at approximately 9:00 a.m. and proceeded to photograph and diagram the incident side and surrounding area. The Staff noted that most of the excavation had been filled-in with backfill material. The backfill covered the new water piping and "blow-off" fittings that had been installed the night before. In the daylight, the Staff was able to observe the extent of the burning around the perimeter of the excavation. The grass was burned in an approximate 24 foot by 22-foot area, extending south-southeast from the south edge of the excavation. A fir tree located approximately four feet east of the excavation was destroyed and a sweet gum tree located approximately 24 feet south of the excavation received burn and heat damage.

The Staff requested that the remaining undamaged natural gas piping, which had been abandoned the night before, and that had not been exposed during the previous water and gas excavation activities the day before, be excavated and removed for examination and pressure testing. A Gas Department backhoe and crew arrived at the incident site at approximately 9:40 a.m. and began

to excavate over the abandoned natural gas piping. The remaining natural gas piping was exposed, removed, and transported to the City Utilities Calhoun office for pressure testing. This piping was at the original end of the natural gas main at the east end of E. Burntwood Street (See Appendix A-3, Figure 3-B). This piping consisted of approximately 4½ feet of 3-inch diameter, PE pipe with a cap on the end, and a 3-inch by ¾-inch service tee and attached ¾-inch diameter, PE tubing that was part of the original service line to 1910 E. Burntwood Street. After this piping was removed, the Staff traveled back to the City Utilities Calhoun office to photograph and pressure test the natural gas piping that had been in the excavation, and to conduct interviews with City Utilities personnel.

Testing of the Removed Natural Gas Piping

All of the damaged and undamaged natural gas piping that had been removed from the excavation was placed on the floor in the City Utilities Calhoun office in the approximate position, as it would have been positioned in the excavation prior to the incident (See Appendix B-4, Photograph 8 and Appendix B-5, Photograph 9). The Staff noted that some of the piping had been totally consumed in the fire. The Staff then diagramed and photographed the piping. All of the undamaged sections of pipe and fittings were pressure tested at 56 psig (the operating pressure at the time of the incident) and no loss of pressure was noted during the testing period indicating that there were no leaks on the undamaged PE natural gas pipe and fittings. After completion of the pressure testing, the Staff made plans to conduct interviews with the Water Department crewmembers that were involved in the incident.

City Utilities Operations and Maintenance Standards, Emergency Procedures, and Training

Operations and Maintenance (O&M) Standards

City Utilities natural gas O&M Standards include procedures for working in and around excavations where a hazardous atmosphere (excavations where the atmospheres within the excavation contains a concentration of flammable gas) exists or could reasonably be expected to exist.[18] These procedures are to be followed by City Utilities Gas Department personnel and contractors performing natural gas work for City Utilities, but these procedures are not required

[18] MoPSC regulation 4 CSR 240-40.030(12)(C)2.J., requires that operators take adequate precautions in excavated trenches to protect personnel from hazards of unsafe accumulations of vapor or gas, and making available, when needed at the excavation, emergency rescue equipment.

for Water Department personnel when working on water facilities in a joint trench with natural gas facilities.

Emergency Procedures

City Utilities has written procedures to minimize the hazards resulting from a pipeline emergency, which includes measures to follow for preventing accidental ignition of natural gas.[19] The measures are to be adhered to by City Utilities Gas Department personnel and contractors performing natural gas work for City Utilities, but these measures are not required for Water Department personnel when working on water facilities in a joint trench with natural gas facilities.

Personnel Training

City Utilities has a written training program for its Gas Department personnel.[20] This program includes only Gas Department personnel and covers such topics as: (1) accidental release of gas; (2) how to recognize emergency conditions; (3) possible ignition sources, indoor/outdoor; (4) job site protection; (5) properties of natural gas; and, (6) natural gas fire fighting.

Excerpts of Witness Interviews

Staff Interviews With the Involved Water Department Crewmembers

> The Staff interviewed three of the four Water Department crewmembers as a group at City Utilities Calhoun office at approximately 11:15 a.m. on September 26, 2002. The injured water crewmember remained in the hospital and would be interviewed at a later date when he recovered sufficiently for the interview to be conducted.
>
> The three crewmembers were in the excavation preparing to connect 1-inch diameter, PVC water service piping to the existing 1-inch diameter, PVC water service piping

[19] MoPSC regulation 4 CSR 240-40.030(13)(X), requires that each operator must take steps to minimize the danger of accidental ignition of gas in any area where the presence of gas constitutes a hazard of fire or explosion.

[20] MoPSC regulation 4 CSR 240-40.030(12)(D)1., requires that no operator may permit an individual (operators themselves, independent contractors and subcontractors, and employees of these contractors) to perform on a pipeline system an operation, maintenance or emergency-response function regulated by this rule unless that individual has been trained and successfully completed a test to demonstrate possession of the knowledge and skills under the training rule.

extending north under E. Burntwood Street and serving 1910 E. Burntwood Street. Approximately 12 inches of the existing 1-inch diameter, PVC water service piping was protruding from the north wall of the excavation and was to be connected to the new water service piping from the water main. Approximately 24 inches of the ¾-inch diameter, PE natural gas service line to 1910 E. Burntwood Street was exposed in the vicinity of the protruding segment of water service piping. According to the water crewmembers, the exposed portion of the ¾-inch diameter, PE natural gas service line piping was located approximately 6 to 8 inches above and approximately 10 to 12 inches laterally to the west from the protruding water service line piping. There was also approximately 7 to 8 feet of 3-inch diameter, PE natural gas main exposed in the excavation. In order to connect the existing segment of 1-inch diameter, PVC water service line piping, that was protruding from the north wall of the excavation, to the new 1-inch diameter, PVC water service line piping from the main, the protruding portion of water service line piping would need to be curved to the west. To bend this portion of water piping, one water crewmember heated the piping using a back and forth motion over the wall surface of the pipe with a propane torch to soften the pipe until it could be bent to the desired direction. During the process of heating the water service line piping with the propane torch, the water crewmembers heard a "whoosh" and saw a "flash". The crewmembers hurriedly exited out of the excavation to the southwest. As they exited the excavation one crewmember dropped the still operating propane torch in the bottom of the excavation.

The Water Department crewmembers indicated that it has been standard practice to heat-bend PVC water service line piping in a joint trench using a propane torch. The heat-bending of PVC water piping has been practiced in the vicinity of plastic natural gas piping in the past without incident. The Water Department crewmembers also indicated that they had not smelled the odor of natural gas near or in the excavation at anytime prior to the incident. In addition, they indicated to Staff that there are no specific safety procedures to follow when heating PVC water service line piping in the vicinity of plastic natural gas lines.

At approximately 10:00 a.m. on October 11, 2002, the Staff conducted a telephone interview with the fourth Water Department crewmember who had been injured in the incident.

The Water Department crewmember indicated that approximately 12 inches of the existing ¾-inch diameter, PE natural gas service line to 1910 E. Burntwood Street was

exposed in the vicinity of where the existing PVC water service line piping to 1910 E. Burntwood Street was being heated with the propane torch. He also indicated that approximately 2 to 3 feet of the 3-inch diameter PE natural gas main was exposed in the excavation. He remembered that the exposed portion of natural gas service line piping was located approximately 6 to 8 inches above the protruding segment of water service line piping. The Water Department crewmember indicated that during the process of heating the water service line piping there was a "swoosh" and "flame", and remembers a "loud sound" in the excavation. He was not the crewmember using the propane torch and did not actually witness the heating of the water piping.

The Water Department crewmember also said that in the past they have used a propane torch to heat-bend PVC water service line piping around plastic natural gas service lines. He also indicated that he had not smelled the odor of natural gas near or in the excavation at anytime prior to the incident.

City Utilities Interviews With the Involved Water Department Crewmembers

City Utilities conducted internal interviews with the involved Water Department crewmembers involved in the incident during September 25-26, 2002 and October 11, 2002. The following are brief statements taken from those combined interviews.

- "Heating 1-inch PVC to "dogleg" a service, using a propane torch. Had been going for some time."
- "No odor detected."
- "Gas service was approximately 10 inches above the water service."
- "Had been using a propane torch to heat the 1-inch PVC water service."
- "Did not smell any gas."
- "Saw the fireball."
- "Did not smell gas at the time of the ignition."
- "Have heated PVC near gas lines before."

<u>City Utilities New Gas and Water Procedures and Training</u>

After the incident, City Utilities formed a review team to review the factors leading up to and contributing to the incident, and to review the post-incident response and then make recommendations to minimize the chance of a recurrence. The City Utilities review team

identified the close proximity of the gas and water facilities, and the presence of a heat source in the excavation near the gas line as the two main contributing factors to the incident. Gas and Water procedures were reviewed and recommendations were made based upon these two main contributing factors. As mentioned in the **Excerpts from Witness Interviews** section of this report, there were no specific procedures of heating PVC pipe in the vicinity of plastic natural gas lines.

Water Department Recommendations and New Policy

City Utilities determined that they have a large amount of gas and water facilities installed in joint trenches. The review team stated that because it does not take a very high temperature for plastic natural gas piping to soften, they believed that a Water Department policy should be developed to only allow heat-bending of PVC pipe outside of an excavation. A new Water Department Policy was developed to specify guidelines for the use of propane torches or other flame heating devices to heat-bend PVC service line piping. The new Water Department Policy is titled **Use of Open Flame Devices** and includes the following guidelines:

Propane torches may be used for heat-bending PVC piping or other uses if the following guidelines are met:

- *Propane torches shall not be used in any excavation.*
- *The propane bottle should be placed a distance of the hose length plus one foot away from the edge of any excavation.*
- *The person using the torch should evaluate the surroundings to make sure the torch could be used safely. At a minimum the operator should be aware of any smells that could indicate the presence of flammable gases or visual indications of flammable material. Torches should never be used when there is a combustible gas leaking or in the atmosphere.*
- *A fire extinguisher should be taken off the truck and placed in an easily accessible location up wind from the area where the torch is being used.*
- *Leather gloves shall be worn while using the torch.*

- *If there is any question of whether or not the heating can be done safely, the operator should contact his or her supervisor.*

Open flame heating devices may be used within a meter tile for the purposes of thawing frozen water piping or appurtenances as long as the following guidelines are met:

- *A visual inspection of the interior of the meter tile shall be made to make sure there are no gas lines or other utilities that could be damaged running through the tile.*

- *The atmosphere inside of the tile shall be checked with combustible gas detector or other acceptable device to verify the absence of flammable gasses. Torches should never be use when there is a combustible gas leaking or in the atmosphere.*

- *A fire extinguisher shall be taken off of the truck and placed in an easily accessible location up wind from the area where the torch is being used.*

- *Leather gloves shall be worn while using the torch.*

- *If there is any question of whether or not the heating can be done safely, the operator should contact his or her supervisor.*

In addition to the above-noted new procedures and guidelines, City Utilities has made several additional recommendations and the department responsible for implementing these recommendations. These recommendations are as follows:

- *All propane bottles should be checked to make sure they have a safety relief valve and the required overpressure protection device (OPD) valve – Water Department.*

- *Fire extinguishers on Water Vehicles should be checked monthly – Water Department.*

- *Nomex suits will be available for Water Department employees who request them – Water Department.*

- *Recommend to the uniform committee that Water uniforms be 100% cotton – Water Department.*

Also, City Utilities has mailed letters to area plumbing contractors explaining the incident and the causes of the incident. In this letter, City Utilities, to help prevent a recurrence of this type of incident, is asking plumbing contractors to review their standard procedures for heating PVC pipe in the ditch around natural gas facilities. The letter also explains the low melt index of plastic natural gas piping and that any heating of an existing plastic natural gas pipe could cause failure and cause a dangerous situation. In addition, the letter informs the plumbing contractor to be aware of the hazards of working near natural gas lines.

Water Department Training

Also, on January 21-22, 2003, City Utilities provided training for Water Department employees on the basics of natural gas. On January 22, 2003 a Staff member observed the training that was conducted with one of the Water Department crews. The training covered such topics as knowing the characteristics and hazards of natural gas, recognizing emergency conditions, indoor and outdoor ignition sources, fire fighting, and recognition of different natural gas facilities. On October 3, 2002, City Utilities also provided hands-on fire training to all Water Department employees at their fire-training site. All of this training will be conducted at three-year intervals.

Gas Department Recommendations

The Water Department Standard for Joint Trench Laterals shows 12 inches of separation between the gas and water piping. The matching Gas Department Standard did not show this same dimension. City Utilities has indicated that often the natural gas and water piping are installed in the same hole for a street crossing. City Utilities recommended that the Gas and Water Standards Committees meet to review these standards and change them so that both the Gas Construction and Water Construction Standards agree with each other. This review resulted in a new Standard (WS-300/GS-230) being issued on December 11, 2002.

Other Recommendations

In conjunction with the previous recommendations and policies, City Utilities has proposed the following general recommendations:

- *Enforce the same procedures on City Utilities contractors. This will be accomplished with an informational meeting to be held with the Tech House and Contract Inspectors.*

- *Communicate possible hazards of the use of torches in ditches to other agencies, such as, Southwestern Bell and MediaCom.*

ANALYSIS

Damage to Plastic Natural Gas Service Line

The damage to the PE natural gas service line for 1910 E. Burntwood Street was the result of an accidentally applied external heat source. Sometime during the heat-bending of the existing PVC water service line with a propane torch by Water Department personnel, the open flame of the torch was near or in contact with the natural gas PE service line for 1910 E. Burntwood Street. Once the open flame of the propane torch came near or in contact with the wall of the ¾-inch diameter, natural gas PE service line, the pipe wall was softened and weakened in a localized area by the high temperature heat generated from the open flame of the propane torch. When the pipe wall weakened, the internal pressure would have exerted enough force to eventually overcome the bursting strength of the pipe. As the external heat from the propane torch continually softened the pipe wall, internal natural gas pressure of approximately 56 psig would have exerted an outward force on the pipe causing the weakened pipe wall to push out and eventually burst.

The Water Department personnel involved in the incident indicated that they did not think that the flame from the propane torch came in direct contact with the exterior wall of the PE natural gas service line. Water Department personnel also indicated that, while heating the PVC water service line, a "pop" was heard along with a "swoosh" and "flame", which was followed by a fire resulting from the ignition of the escaping natural gas. The approximate horizontal and vertical separation distances between the area being heated on the PVC water service line and the ¾-inch diameter, PE natural gas service line were indeterminate, due to conflicting information from the Water Department crewmembers. However, based upon their collective information, the exposed segment of the ¾-inch diameter, PE natural gas service line was approximately 6 to 8 inches above and approximately 10 to 12 inches laterally to the west from the segment of PVC water service line that was being heated with the propane torch.

The ¾-inch diameter, PE natural gas service line is a plastic material that had a softening point of approximately 250º F. Given the close proximity of the gas and water service lines at the location where the PVC water service line was being heated with the propane torch, there would have been sufficient radiant and convective[21] heat generated from the open flame of the propane torch to soften the PE natural gas service line to the point of failure.

[21] Convection is the transfer of heat through a medium, such as air, from the source of heat to a cooler part of the environment.

Natural Gas Escape and Ignition

After failure of the ¾-inch PE, natural gas service line, natural gas would have exited from the failure in the service line at a pressure of approximately 56 psig. Since natural gas is lighter than air, it would have escaped up into the atmosphere of the open excavation. Since the natural gas service line was exposed and the excavation was open, there would have been no resistance to the upward flow of natural gas. The natural gas, at an explosive mixture,[22] was most likely ignited by the open flame of the propane torch.

Test Results of the Undamaged Segments of Plastic Natural Gas Main and Service Line Piping

As mentioned in the **Commission Staff Actions and Investigation** section of this report, the undamaged segments of the plastic natural gas service line and main piping were removed from the excavation and transported to the City Utilities Calhoun office for testing. The undamaged segments of natural gas service line and main piping, and fittings, were pressure tested at 56 psig (the operating pressure at the time of the incident) and no loss of pressure was noted during the testing period. This would indicate that there were no leaks on the undamaged segment of natural gas piping prior to the incident. However, also as mentioned in the **Commission Staff Actions and Investigation** section of this report, there were segments of the natural gas service line and main that were totally consumed by the fire. Subsequently, a determination could not be made regarding what the integrity of this piping was prior to the incident.

Prior and Post Incident Leak Surveys and Water Department Crewmembers Interviews

As mentioned in the **Previous City Utilities Actions** section of this report, leak surveys conducted in the 1800 and 1900 block of E. Burntwood Street on September 6, 2000, indicated that there were no belowground leaks in the vicinity of 1904 E. Burntwood Street at that time. Also, as mentioned in the **City Utilities Notification, Actions and Observations** section of this report, leak surveys conducted in the vicinity of 1904 E. Burntwood Street immediately following the incident, indicated that there were no belowground leaks present at that time.

Staff interviews with the Water Department crewmembers that were involved in the incident indicated that the odor of natural gas was not detected at any time while they were working in the

[22] The explosive range of natural gas is a mixture of between 4.5% and 14.5% gas-in-air.

excavation prior to the incident. Odorant intensity tests conducted in the area of the incident prior to and immediately after the incident indicated that the natural gas contained the required concentration of odorant to make it readily detectable by individuals with a normal sense of smell. It is likely that if there had been any leaking natural gas in the excavation prior to the incident, the Water Department crewmembers would have detected the odor of natural gas.

Based upon the negative results of the leak surveys conducted prior to and after the incident, and the fact that the Water Department crewmembers did not detect the odor of natural gas while they were working in the excavation, it is likely that there were no existing belowground natural gas leaks that could have contributed to the incident.

Water Department Work Practices

The practice of heat-bending PVC water service line piping with a propane torch by Water Department personnel was a normal procedure and under normal circumstances should be a completely safe operation. However, in this incident, the heat-bending of the PVC water service line piping had been conducted in close proximity to the PE natural gas service line piping. The softening of the PE natural gas service line, either by convective heat generated from the open flame of the propane torch or by direct contact with the open flame of the propane torch, probably was not evident to the Water Department workers before complete failure of the natural gas service line occurred.

City Utilities did not have any written procedures regarding the practice of heat-bending PVC water piping, nor did the Gas Department have any specific knowledge that this practice was being conducted by the Water Department in excavations in close proximity to natural gas facilities. Consequently, there were no specific procedures or warnings given to Water Department personnel concerning the protection of natural gas facilities when water construction activities were occurring near natural gas facilities. As required by the MoPSC pipeline safety requirements, City Utilities operations and maintenance procedures and standards include procedures for working in and around excavations where a hazardous atmosphere exists or could reasonably be expected to exist. Also, City Utilities has written procedures to minimize the hazards resulting from a pipeline emergency, which includes measures to follow for preventing accidental ignition of natural gas. However, these procedures and measures are only required for personnel who are performing natural gas work and would not be required for Water Department personnel who are merely working near natural gas facilities.

In addition, City Utilities has a written training program for its Gas Department employees, as required by the MoPSC pipeline safety requirements, which includes such topics as: (1) accidental release of gas; (2) how to recognize emergency conditions; (3) possible ignition sources, indoor/outdoor; (4) job site protection; (5) properties of natural gas; and, (6) natural gas fire fighting. However, also, as stated in the preceding paragraph, this training is only required for personnel working on the natural gas system and would not be required for Water Department personnel who are merely working near natural gas facilities.

The Staff believes the damage to the PE natural gas service line was an isolated situation and was probably unforeseen by the Water Department workers. The damage was also unforeseen by the Gas Department since they were unaware of the practice of heat-bending PVC water pipe, especially in close proximity to PE natural gas lines.

The Staff believes that measures should be taken by City Utilities to protect their natural gas facilities and to protect personnel anytime there is the potential for a sudden release of gas. These measures and/or precautions should include, but not be limited to, limiting the use of heat-bending PVC water pipe in close proximity to natural gas facilities and emergency natural gas training for Water Department personnel since they work in common trenches with natural gas piping.

New Gas and Water Procedures and Training

Soon after the incident and prior to recommendations from the MoPSC, City Utilities formed a team to review the factors leading up to and contributing to the incident. As a result of this review, City Utilities has implemented new procedures (the new procedures and training are outlined in the **City Utilities New Gas and Water Procedures and Training** section of this report). The procedures forbid the use of propane torches in any excavation and training for Water Department employees that includes the characteristics and hazards of natural gas, recognizing emergency conditions, recognizing outdoor ignition sources, fire fighting, and recognizing different natural gas facilities that might be encountered in an excavation. The Staff believes that these new procedures satisfy Staff's issues concerning the use of open flames in close proximity to natural gas facilities. The Staff also believes, since Water Department employees work in common trenches with natural gas facilities that the new natural gas training for Water Department employees is very appropriate and hopefully should help protect these employees anytime they are working near natural gas lines.

CONCLUSIONS

1. At approximately 3:30 p.m., CDST, Wednesday, September 25, 2002, a fire involving natural gas occurred in an excavation in front of 1904 E. Burntwood Street in Springfield, Missouri.

2. One injury resulted from the fire. A Water Department employee for City Utilities of Springfield received third degree burns to his right arm and wrist, and lesser burns to his face and ears. He was transported to St. John's Medical Center Burn Unit in Springfield, Missouri where he remained 6 days for treatment and skin grafting.

3. The resulting fire both destroyed and damaged natural gas and water facilities in the excavation, and damaged cable TV and electric power lines above the excavation. Two trees in the front yard of 1904 E. Burntwood Street and near the excavation were also damaged.

4. The probable cause of the incident was the ignition of natural gas in the atmosphere, in and above the excavation in front of 1904 E. Burntwood Street. The natural gas originated from a damaged portion of ¾-inch diameter PE natural gas service line in the excavation. The natural gas escaped upward into the atmosphere in and above the excavation and was ignited. The probable source of ignition was not determined, but most likely was the open flame of a propane torch that was being operated in the excavation.

5. The damage to the ¾-inch diameter, PE natural gas service line to 1910 E. Burntwood Street was caused by the accidental application of an external heat source during water construction work on September 25, 2002, by City Utilities Water Department personnel. During September 25, 2002, a Water Department employee was using a propane torch to heat-bend a segment of 1-inch diameter water service line that was near the ¾-inch diameter PE natural gas service line. The open flame of the propane torch was in close proximity or came in contact with the PE service line and the wall of the ¾-inch diameter PE natural gas service line was then softened and weakened due to the heat effects from the flame emitted by the propane torch. As a result, the effective bursting strength of the PE service line was reduced and natural gas escaped through the weakened wall of the PE pipe. The escaping natural gas was most likely ignited by the open flame of the propane torch and a fire resulted.

6. The combination of two factors contributed to the damage to the PE natural gas service line. One was the close proximity of the natural gas service line to the PVC water service line. The second factor was the presence of a heat source in the excavation near the PE natural gas service line in the form of the open flame emitted from the propane torch.

7. City Utilities responded to the damage and fire immediately, and the investigations to identify the extent of migration of any escaping natural gas, and stopping the flow of escaping natural gas were conducted in a timely manner.

8. City Utilities did not have any procedures for heat-bending PVC water pipe nor did the Gas Department have any knowledge that this practice was being conducted near natural gas facilities by the Water Department.

9. Prior and post incident leak surveys indicated that there were no belowground natural leaks in the area that could have contributed to the incident. Also, Water Department workers who were working in the excavation did not smell the odor of natural gas. In addition, tests of the salvaged undamaged natural gas piping from the excavation indicated that there were no leaks on the gas piping prior to the incident. However, the integrity of some small segments of natural gas piping could not be determined, because this piping had been totally consumed in the fire.

10. After the incident, City Utilities quickly developed and implemented new procedures for the Water Department that should eliminate future heat damage to PE natural gas piping by forbidding the heat-bending of PVC water pipe in any excavation. Also, the new training developed and implemented for Water Department employees after the incident should better prepare them for working in common trenches with natural gas facilities by providing training on natural gas emergencies, characteristics and hazards of natural gas, recognizing emergency conditions, recognizing ignition sources, fire fighting, and recognizing different natural gas facilities that may be encountered in an excavation.

11. The City Utilities Water Department was not under the jurisdiction of the MoPSC pipeline safety regulations. The Water Department employees were merely working in the same excavation with natural gas facilities and not directly working on the natural gas piping.

12. The Staff's investigation did not reveal any violations of Missouri Public Service Commission's regulations by City Utilities that could have contributed to the incident.

RECOMMENDATIONS

1. Normally, Staff would make recommendations to the operator in this section of the report. However, soon after this incident, City Utilities formed a review team to review the factors leading up to and contributing to the incident. As a result of this review, City Utilities has implemented new procedures and training for the Water Department. The Staff commends City Utilities for taking the initiative to respond in a positive way with implementation of new procedures and training for the Water Department.

   The Staff believes City Utilities has adequately addressed Staff's concerns with the heat-bending of PVC water pipe in an excavation near natural gas facilities by implementing new procedures for the use of heat-bending PVC piping and training for Water Department employees who work in common trenches with natural gas facilities where there is the possibility of the release of natural gas. (See guidelines in **Water Department Recommendations and New Policy**, page 18)

   Also, the new procedures for the Water Department include guidelines for the use of open flame heating devices within a meter tile for the purposes of thawing frozen water piping. (See guidelines in **Water Department Recommendations and New Policy,** page 19.)

   In addition, City Utilities has notified area plumbing contractors of the hazards of heat-bending PVC pipe in excavations around natural gas facilities and has recommended the communicating of possible hazards of the use of torches in excavations to other agencies, such as, Southwestern Bell and the local cable companies.

   Finally, City Utilities has addressed Staff's concerns regarding natural gas knowledge for Water Department employees working in common trenches with natural gas facilities by providing training to these employees. The Staff believes this training should provide Water Department employees the resources and knowledge needed to properly and safely work in excavations that contain natural gas facilities.

   Therefore, for all the foregoing reasons, Staff believes that City Utilities new procedures and training adequately address the Staff's issues and concerns regarding this incident.

2. The Staff invites City Utilities and other interested parties to file a response to this Incident Report in Case No. GS-2003-0129 within thirty (30) days of the filing of this Report for review by the Commission. If no responses are filed within 30 days, the Staff recommends that this Case (Case No. GS-2003-0129) be closed.

APPENDIX A

(Figures)

Map of the Surrounding Area of Springfield, Missouri.
(The above map was provided by MapQuest)

Overall satellite image of 1904 E. Burntwood Street. The satellite image was provided by the Microsoft Terra Server in conjunction with the United States Geological Services (USGS). The above image was taken on March 10, 1996.

Figure 1
Overall View of 1904 E. Burntwood Street-Incident Location
Appendix A-1

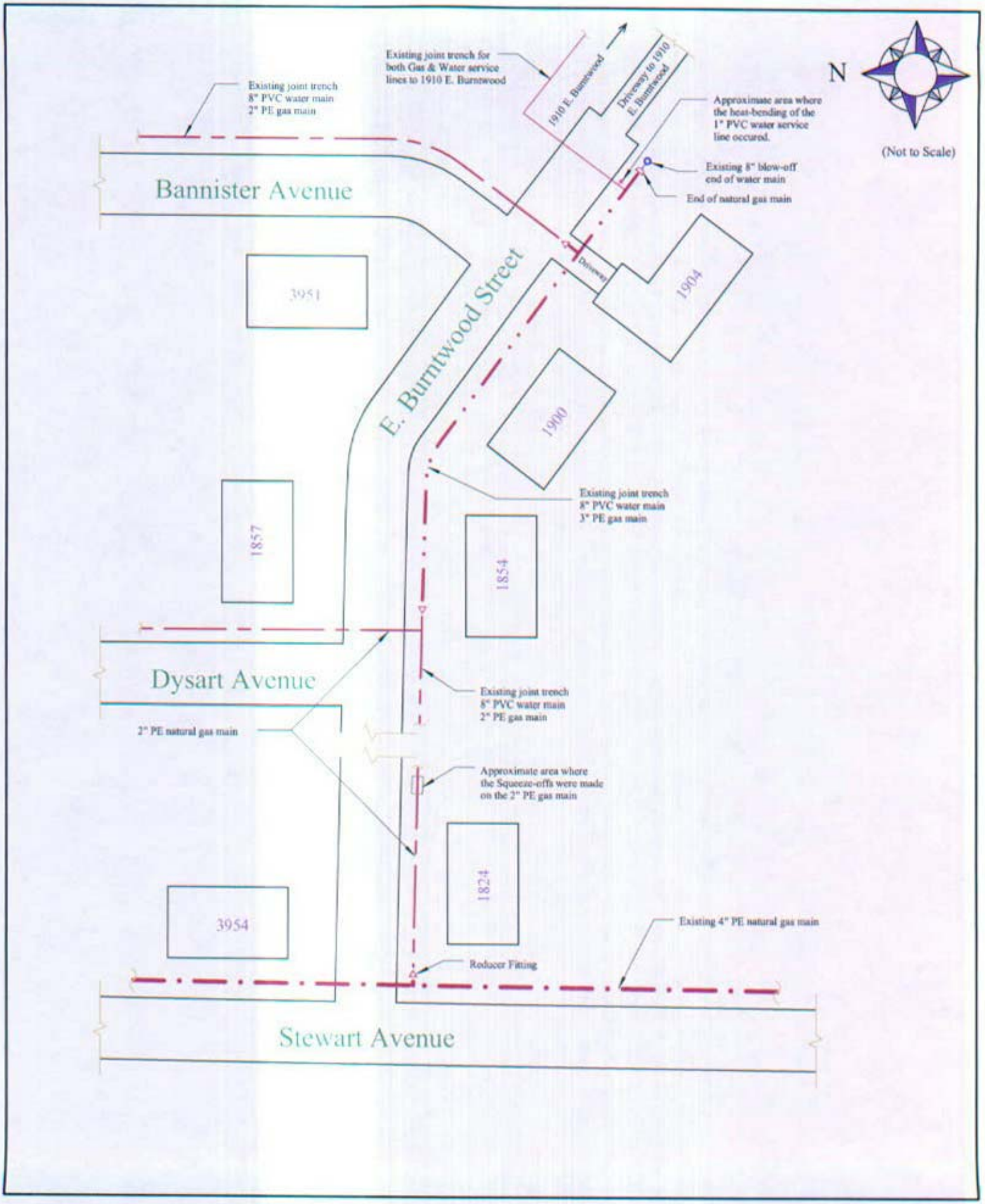


Figure 2
Plan View of 1904 E. Burntwood Street-Incident Location
Appendix A-2

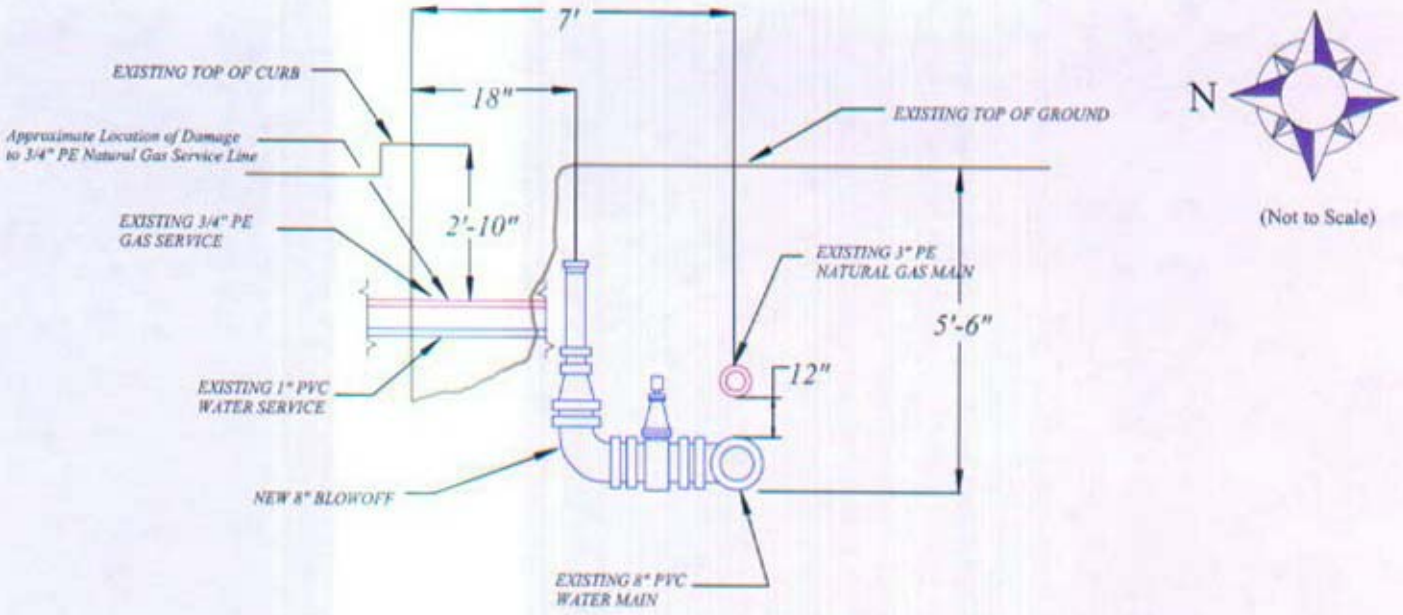


Figure 3-A (Side View-Looking East)

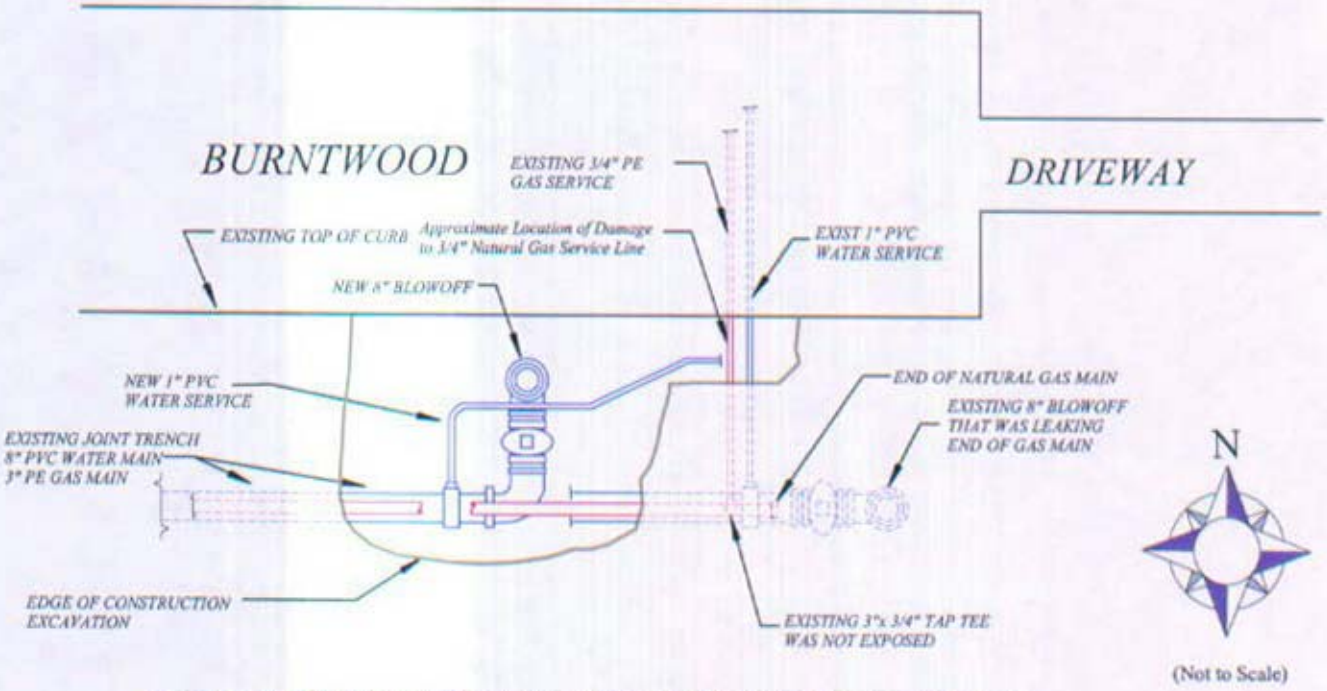


Figure 3-B (Top View of Excavation in Front of 1904 E. Burntwood Street)

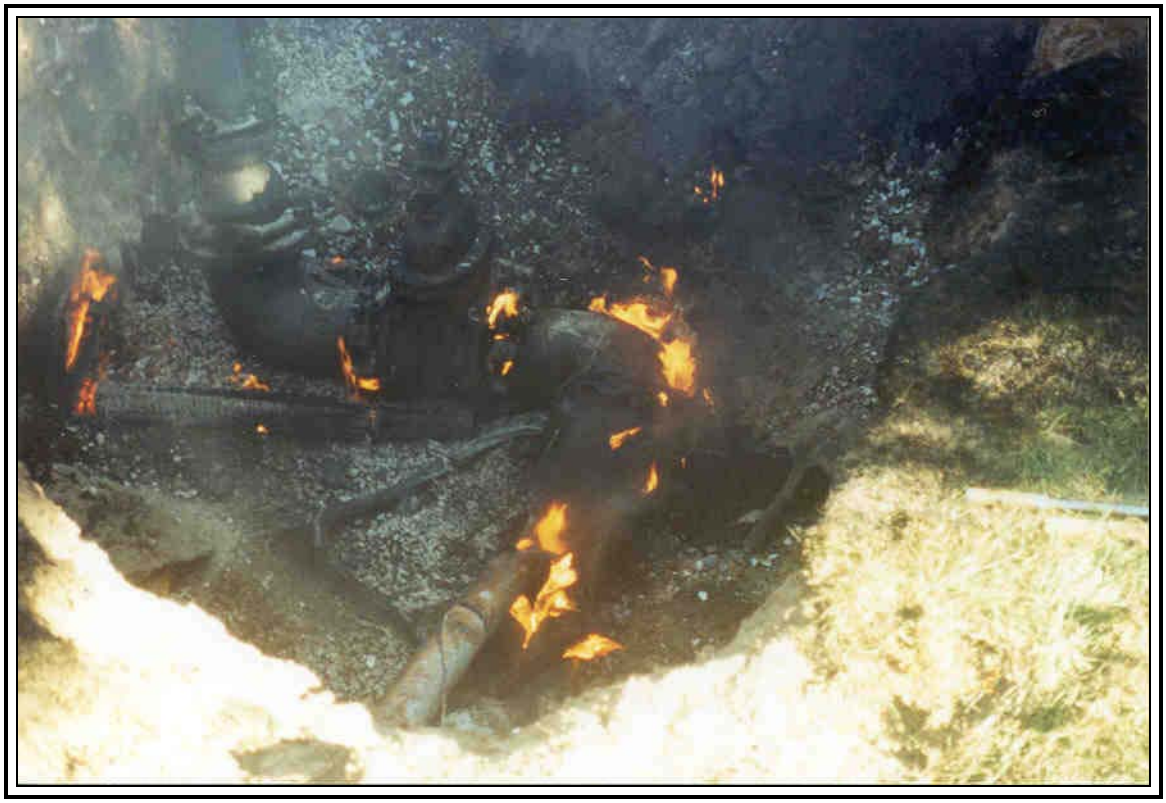
Figure 3
Joint Trench Schematics (Drawings provided by City Utilities of Springfield)
Appendix A-3

APPENDIX B

(Photographs)

Photograph 1: View looking east as the natural gas fire was in progress in front of 1904 E. Burntwood Street. (Courtesy photograph provided by City Utilities of Springfield)

Photograph 2: Close-up view of the natural gas fire looking southeast. (Courtesy photograph provided by City Utilities of Springfield)

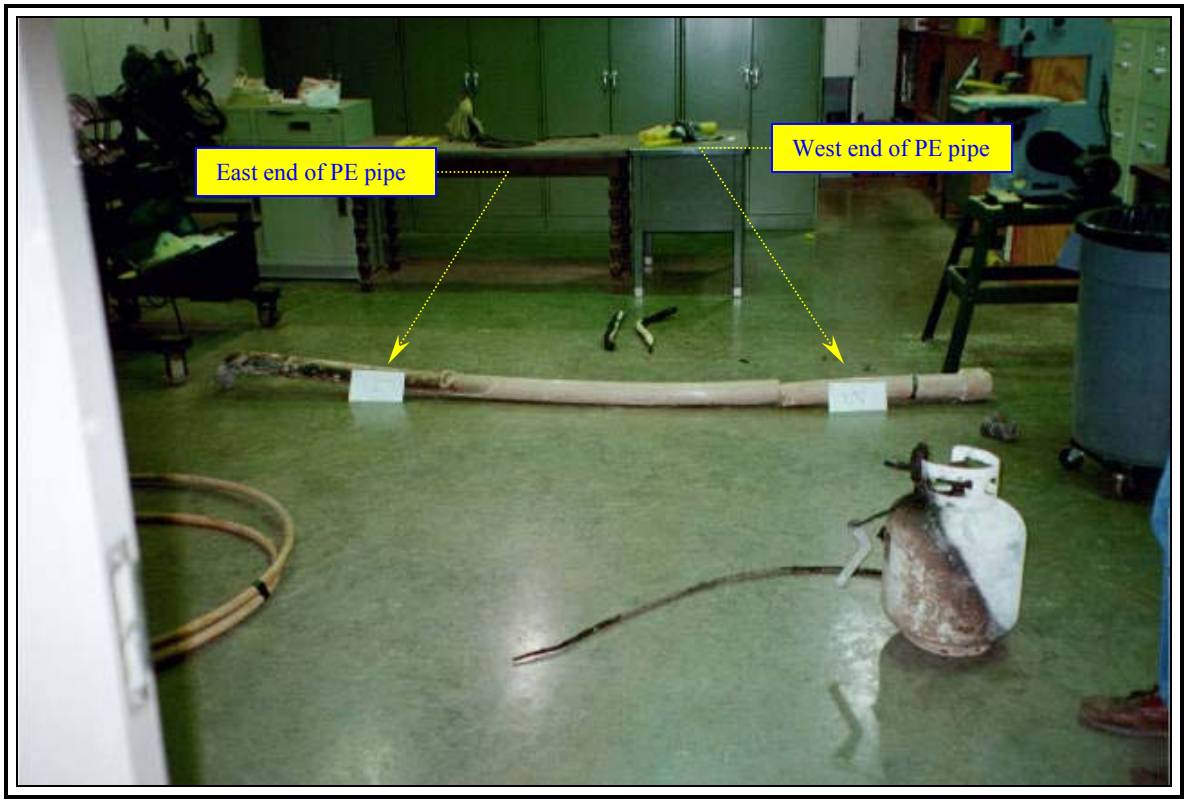


Photograph 3: Looking east at the natural gas and water piping appurtenances still burning in the excavation in front of 1904 E. Burntwood Street.
(Courtesy photograph provided by City Utilities of Springfield)

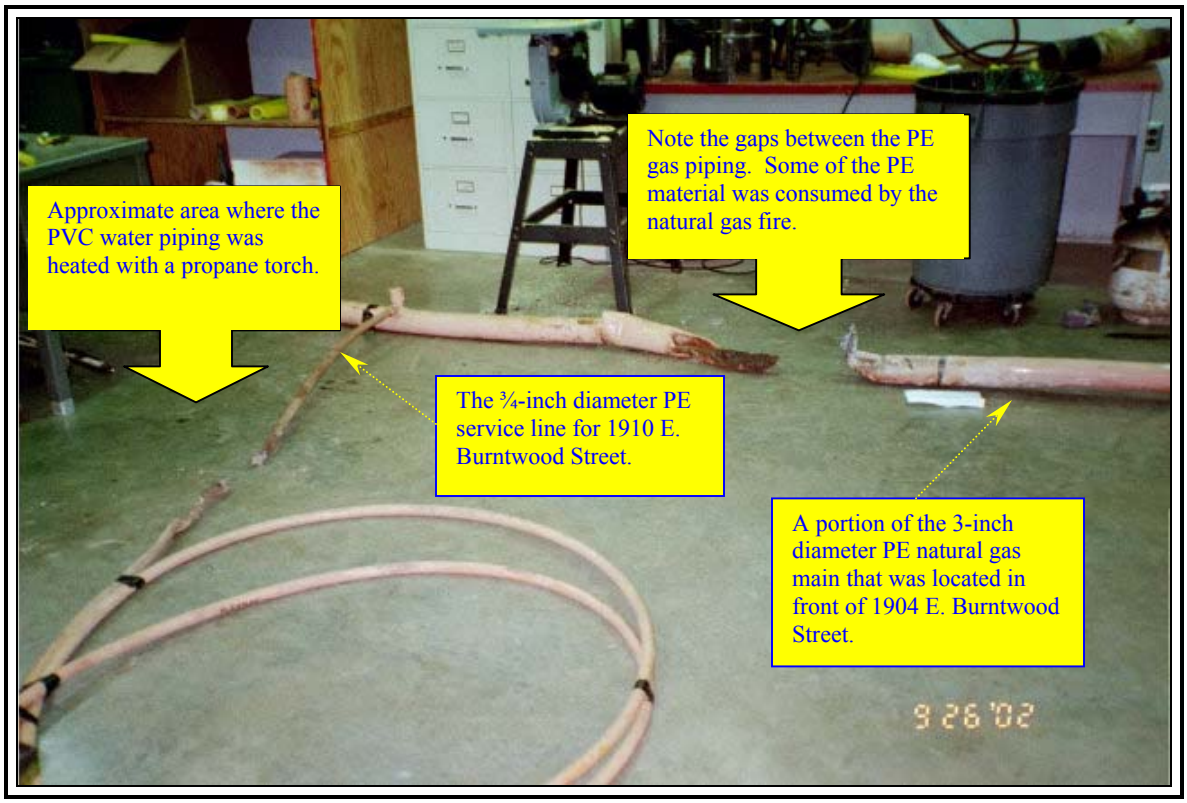
Photograph 4: View of the new natural gas PE piping that was installed on the evening of 9/25/02 to restore natural gas service to 1910 E. Burntwood Street.

Photograph 5: View of the burned segments (in the background) of 3-inch diameter PE natural gas piping that were removed from the excavation on the evening of 9/25/02.

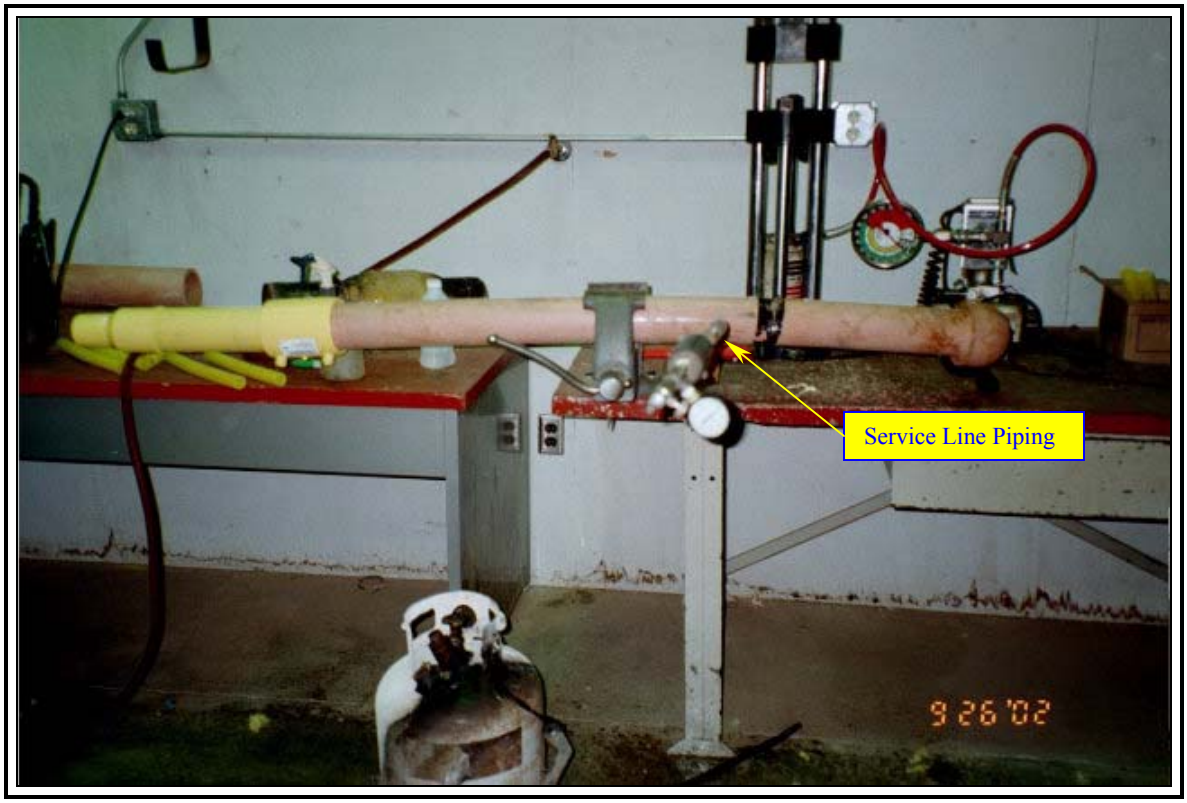
Photograph 6: View of the 20-pound propane tank that was being used by the City Utilities Water Department crew.



Photograph 7: View of the 3-inch diameter PE natural gas main and propane tank that were removed from the excavation. The plastic piping was oriented in the approximate position that the natural gas facilities would have been positioned prior to the incident.



Photograph 8: Approximate layout of the burned 3-inch diameter PE natural gas main and ¾-inch diameter natural gas service line that was removed on 9/26/02.



Photograph 9: Pressure test of the intact portion of 3-inch diameter PE natural gas main and tapping tee with service line piping (small segment) that served 1910 E. Burntwood Street. This natural gas piping was removed from the excavation in front of 1904 E. Burntwood Street on 9/26/02. A new section of yellow PE piping was added (upper left side of photograph) to facilitate the pressure test.