BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Laclede Gas Company Concerning a Natural Gas Incident at Premio Lane in Fenton, Missouri	)))	Case No. GS-2007-0130

STAFF GAS INCIDENT REPORT

COMES NOW the Staff of the Missouri Public Service Commission (Staff) and in support of its *Gas Incident Report*, states as follows:

1. On September 26, 2006, *Staff's Request To Establish A Case For Investigation Of Gas Safety Incident* was filed to initiate the above-captioned case.

2. On October 5, 2006, the Commission issued its *Order Granting Request To Open Case For Investigation Of A Natural Gas Incident* (Order) for the purpose of receiving the *Gas Incident Report* (Report) resulting from Staff's formal investigation of the incident that occurred in Fenton on September 12, 2006. The Order states "Any responses to Staff's report shall be filed 30 days after Staff files its report."

3. Staff has investigated the incident that occurred in Fenton and submits its Report attached hereto as Exhibit A, which includes supporting Appendices A through E, and is incorporated by reference herein.

4. Because Staff's Report contains a recommendation for Laclede Gas Company that was developed from its investigation, Staff requests the Commission issue an order requiring Laclede Gas Company to file a response addressing Staff's recommendation (no. 4, page 4 of Exhibit A) no later than 30 days after the filing of this Report.

5. As described in Staff's Report, the natural gas pipeline involved in this incident was damaged by a contractor installing electric cable for AmerenUE. Because Staff's Report

also contains recommendations for AmerenUE[1], Staff requests the Commission issue an order requiring AmerenUE to file a response addressing Staff's recommendations (no.'s 1, 2 and 3 on page 4 of Exhibit A) no later than 30 days after the filing of this Report.

6. Staff's Report also proposes, in recommendation no. 6 on page 4 of Exhibit A, that the Commission advise and remind utilities installing underground cable or conduit to follow certain safety requirements. To this end, the Staff is prepared to assist the Commission in this recommendation.

WHEREFORE, pursuant to the Commission's Order establishing this case, the Staff submits its Report, and prays the Commission to issue an order directing AmerenUE and Laclede Gas Company to file a response addressing Staff's recommendations no later than 30 days after the filing of this Report.

Respectfully submitted,

/s/ Robert S. Berlin
Robert S. Berlin
Senior Counsel
Missouri Bar No. 51709

Attorney for the Staff of the
Missouri Public Service Commission
P. O. Box 360
Jefferson City, MO 65102
(573) 526-7779 (Telephone)
(573) 751-9285 (Fax)
bob.berlin@psc.mo.gov

[1] In *Staff's Request To Establish A Case For Investigation of Gas Safety Incident* filed Sept. 26, 2006, the Staff, in its early stages of investigating this incident, did not formally make AmerenUE a party to this case. Subsequently, because Staff developed recommendations pertaining to AmerenUE, whose contractor damaged Laclede's pipeline, the Staff filed its *Motion to Join AmerenUE* on January 31, 2007.

Certificate of Service

I hereby certify that copies of the foregoing have been mailed, hand-delivered, transmitted by facsimile or e-mailed to all counsel of record and counsel for AmerenUE this 2nd day of February 2007.

/s/ Robert S. Berlin

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Laclede Gas Company	)	
Concerning a Natural Gas Incident at	)	Case No. GS-2007-0130
Premio Lane in Fenton, Missouri	)	

VERIFICATION

STATE OF MISSOURI)
)
COUNTY OF COLE)

I, John D. Kottwitz, Utility Engineering Specialist III in the Commission's Energy – Safety/Engineering Department, of lawful age, on oath state: that I participated in the preparation of the Gas Incident Report that is being filed in the above case on February 2, 2007, consisting of 21 pages and Appendices A through E; that information in the Gas Incident Report was given by Laclede Gas Company and AmerenUE; that I have true knowledge of the matters set forth in such report; and that such matters are true to the best of my knowledge and belief.

John D. Kottwitz

John D. Kottwitz

Subscribed and sworn to before me this 2nd day of February, 2007.

Sharon S. Wiles

NOTARY PUBLIC

SHARON S. WILES
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: October 23, 2010
Commission Number: 06429091

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Laclede Gas Company Concerning a Natural Gas Incident at Premio Lane in Fenton, Missouri	)))	Case No. GS-2007-0130

VERIFICATION

STATE OF MISSOURI)
)
COUNTY OF COLE)

I, Kevin Kovarik, Utility Engineering Specialist II in the Commission's Energy – Safety/Engineering Department, of lawful age, on oath state: that I participated in the preparation of the Gas Incident Report that is being filed in the above case on February 2, 2007, consisting of 21 pages and Appendices A through E; that information in the Gas Incident Report was given by Laclede Gas Company and AmerenUE; that I have true knowledge of the matters set forth in such report; and that such matters are true to the best of my knowledge and belief.

Kevin P. Kovarik

Kevin P. Kovarik

Subscribed and sworn to before me this 2nd day of February, 2007.

Sharon S. Wiles

NOTARY PUBLIC

SHARON S. WILES
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: October 23, 2010
Commission Number: 06429091

Missouri Public Service Commission

Gas Incident Report

Laclede Gas
Case No. GS-2007-0130

Fenton, Missouri
September 12, 2006

Energy Department ... Utility Operations Division
February 2007… Jefferson City, Missouri

Exhibit A

Table of Contents

SYNOPSIS

At approximately 3:05 p.m. on September 12, 2006, a natural gas explosion and subsequent fire occurred at 1390 Premio Drive in Fenton, Missouri. The single-family residence located at 1390 Premio Drive and its contents were destroyed as a result of the explosion and subsequent fire. One occupant was driving away on Premio Drive at the time of the incident, and no one else was inside the structure. The neighboring residences at 1386 Premio Drive and 1394 Premio Drive were also damaged as a result of the explosion. There were no injuries as a result of the incident.

Laclede Gas Company (Laclede) provides natural gas service in Fenton, Missouri. The residences from 1390 Premio to 1398 Premio are supplied natural gas through a 2-inch diameter polyethylene main installed along the west side of Premio Drive. The natural gas main was operating at approximately 36 pounds per square-inch gauge (psig) at the time of the incident.

The Missouri Public Service Commission's Energy Department Staff (Staff) has determined that the probable cause of the incident was the escape of natural gas from the 2-inch diameter natural gas main, which had a hole in the bottom half of the polyethylene pipe. The escaping natural gas migrated through backfill material, along the concrete driveway at 1390 Premio Drive, and through nearby sewers. The migrating natural gas then accumulated within the structure located at 1390 Premio Drive and was ignited by an undetermined source.

The natural gas main was damaged during construction work on September 12, 2006 by ADB Utility Contractors, a construction contractor for AmerenUE. ADB Utility Contractors was using horizontal directional drilling equipment to bore beneath Premio Drive in preparation for installing an underground electric cable. After drilling under Premio Drive from east to west, the drill head came in contact with the 2-inch diameter natural gas main and drilled through the bottom half of the polyethylene pipe. Prior to this excavation, the location of the natural gas main had been accurately marked with yellow paint on the ground surface.

The probable cause of the third-party damage to the natural gas main was the inability of ADB Utility Contractors to accurately track the location of the drill head. ADB Utility Contractors personnel indicated that they believed the drill head was at a location that was later measured as approximately 36 inches east of the natural gas main, when it was actually in the bottom half of the natural gas main. The reason for this substantial difference in location was not determined.

During the investigation into this incident, the Staff did not discover any violations of the Missouri Public Service Commission (Commission or MoPSC) regulations that may have contributed to the incident. As a result of the Staff's investigation, this report contains four recommendations to AmerenUE, two recommendations to Laclede, and one recommendation to the Commission.

CONCLUSIONS

1. At approximately 3:05 p.m. on September 12, 2006, an explosion and subsequent fire involving natural gas occurred at 1390 Premio Drive in Fenton, Missouri.

2. There were no injuries as a result of the explosion and subsequent fire.

3. The explosion and subsequent fire destroyed the residence at 1390 Premio Drive. Two other neighboring residences received exterior damage but were otherwise intact.

4. The probable cause of the incident was the ignition of natural gas that had escaped from a hole in a 2-inch diameter natural gas main located about 50 feet north of the northeast corner of the structure at 1390 Premio. The natural gas migrated through soil backfill around the natural gas main, along the ditches of the natural gas main and service lines, under and along the concrete driveway, sidewalk, and street, and through nearby sewers. The natural gas migrated to and into 1390 Premio Drive through one or more entry locations, accumulated, and was ignited. The probable source of ignition was not determined.

5. The hole in the 2-inch diameter natural gas main was caused by third-party damage when ADB Utility Contractors, a construction contractor for AmerenUE, was using horizontal directional drilling (HDD) equipment in preparation to install an underground electrical conduit under Premio Drive. HDD is a type of horizontal boring. During the HDD process, the drill head drilled through the bottom half of the 2-inch diameter polyethylene pipe.

6. ADB Utility Contractors had notified Missouri One Call System, Inc. of their intent to excavate for a new electric conduit and cable along and across Premio Drive. Pursuant to the excavation notification, a locating contractor for Laclede accurately located and marked the location of the natural gas main with yellow paint on August 28, 2006. Laclede did not identify this horizontal boring project for an excavation inspection since it was not near a critical facility.

7. The probable cause of the third-party damage was the inability of ADB Utility Contractors to accurately track the location of the drill head. ADB Utility Contractors personnel indicated that they believed the drill head was at a location that was measured by the Staff to be approximately 36 inches east of the natural gas main (before reaching the main), when it was actually in the bottom half of the natural gas main. The reason for this substantial difference in location was not determined.

8. It is probable that the damage to the natural gas main (and subsequent explosion) would not have occurred if ADB Utility Contractors had known the actual location of the drill head or taken other actions to confirm the actual location of the drill head before it damaged the natural gas main.

9. ADB Utility Contractors reported the damaged natural gas facility to Laclede and Missouri One Call System, Inc., but did not call 911.

10. Laclede responded to the report of a damaged main immediately and arrived as the explosion occurred. Laclede's investigations to identify the extent of migration of the escaping natural gas and actions to stop the flow of escaping natural gas were conducted in a timely manner. A safety zone was established and the Laclede's emergency procedures were effectively implemented.

11. ADB Utility Contractors had accidentally hit the natural gas service line for 1383 Premio on September 6, 2006, while attempting to pothole it. ADB Utility Contractors potholed this service line because they were planning on crossing it during the horizontal boring. However, ADB Utility Contractors did not pothole the natural gas main that was damaged on September 12 because they planned to stop the horizontal boring process near to the electric pedestal and before reaching the natural gas main.

12. Laclede's damage prevention program exceeds the minimum requirements in several aspects**.** Laclede meets the minimum requirements in the excavation inspection portion of the damage prevention program and has a practice to conduct inspections of excavations near critical facilities. Since most of Laclede's facilities are not considered critical, most excavations (including most horizontal boring projects) are not inspected by Laclede.

13. Even though Laclede did not schedule an excavation inspection of the horizontal boring project on Premio Drive, Laclede personnel did visit the project on September 6 when a service line was damaged and observed that ADB Utility Contractors was potholing the service line. The use of potholing demonstrated to Laclede that ADB Utility Contractors was taking actions to avoid damaging the marked natural gas facilities that were being crossed by the horizontal boring project.

14. The Staff's investigation revealed no violations of Commission regulations by AmerenUE or Laclede that contributed to the incident. As a result of the Staff's investigation, this report contains four recommendations to AmerenUE, two recommendations to Laclede, and one recommendation to the Commission.

RECOMMENDATIONS

1. The Staff recommends that AmerenUE review the circumstances of this incident and take precautions to avoid reoccurrence when AmerenUE or its contractors are installing buried electric cables or conduits. Specifically when horizontal boring excavations are in the vicinity of a natural gas facility, AmerenUE or its contractors should verify that the location of the boring device is outside of the marked approximate location of the natural gas facility. The Staff also recommends that AmerenUE and its contractors continue to follow the statutory requirement in RSMo 319.037 (see Appendix C) that an excavator make efforts to confirm the horizontal and vertical location of a marked underground facility when horizontal boring within the marked approximate location.

2. The Staff recommends that AmerenUE or its contractors call 911 in addition to Laclede (or the involved gas facility operator if not Laclede) when a natural gas facility is damaged and natural gas is escaping as required by Federal law.

3. The Staff recommends that AmerenUE review the procedures, practices, training, and number of personnel that are used for the inspection of electric cable installations by contractors to determine what revisions are needed. AmerenUE should ensure that each electric cable is installed in accordance with the Commission's rules. The Staff recommends that AmerenUE submit the results of the review and an estimated schedule for actions to the Staff.

4. The Staff recommends that Laclede review the procedures, practices, training, and number of personnel that are used for excavation inspections in the vicinity of its natural gas pipelines and determine how to increase the number of excavation inspections conducted. The Staff specifically recommends that Laclede have a goal to make at least one visit to each horizontal boring project during the course of the project, especially when the excavator has a history of damaging Laclede facilities during horizontal boring excavations. The Staff recommends that Laclede submit the results of the review and an estimated schedule for actions to the Staff.

5. The Staff recommends that AmerenUE be directed to file a response in this Case regarding Recommendations 1 – 3, and Laclede be directed to file a response in this Case regarding Recommendation 4 within 30 days of the filing of this report.

6. The Staff recommends that the Commission consider advising electric utilities, telecommunication companies and rural electric cooperatives of this incident and the need to follow the safety requirements in the Commission's rules and RSMo 319.10 through 319.050 when installing underground cable or conduit using horizontal boring equipment. This information should discuss the need to confirm the location of natural gas facilities when in the vicinity of horizontal boring excavations by the utility or their contractors. The Staff also recommends addressing the new Federal law that all excavators, when gas is escaping after damaging a natural gas facility, call 911 in addition to the gas facility operator. (A reference for this recommendation is the Staff letter to these entities in June of 2001.)

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 3:05 p.m. (Central Daylight Time), on Tuesday, September 12, 2006, an explosion and subsequent fire occurred in a single-family residence at 1390 Premio Drive in Fenton, Missouri (see Appendix A-1, Figure 1).

Personal Injuries

Only one occupant of the involved residence was at home prior to the explosion. He was driving away on Premio Drive at the time of the explosion and was not injured. Several other neighboring homes were occupied at the time of the explosion and these occupants had to be evacuated, however no injuries were reported.

Property Damage

The residential structure located at 1390 Premio Drive and its contents were destroyed as a result of the explosion and subsequent fire (see Appendix B-1, Photograph 1). The adjacent single-family residences at 1386 and 1394 Premio received moderate exterior damage to the siding due to the fire. Laclede estimated the property damage and loss for the affected homes at approximately $300,000[1].

Meteorological Data

The high and low temperatures observed in St. Louis, Missouri on September 11 and 12 were 81°F/68°F and 72°F/61°F, respectively. Precipitation measured for September 11 was 0.4 inches.

Natural Gas System

Natural gas service in Fenton, Missouri is provided by Laclede. The distribution main supplying 1390 to 1398 Premio Drive is a 2-inch diameter polyethylene pipe located parallel to and 6 feet west of the west curb line (see Appendix A-2, Figure 2). This main was installed by Laclede between February 26 and April 7, 1976. The main was operating at a pressure of approximately 36 psig at the time of the incident. The maximum allowable operating pressure (MAOP) established by Laclede for this main is 60 psig.

The natural gas service line for 1390 Premio Drive was a ½-inch diameter polyethylene pipe that was installed by Laclede on February 7, 1978. The service line extended from the main to the natural gas meter located on the southeast side of the house.

[1] Information obtained from the PHMSA F 7100.1 Federal Incident Report form submitted by Laclede to the Staff.

Previous Laclede Actions

Laclede's Damage Prevention Program

Laclede carries out a damage prevention program as required by 4 CSR 240-40.030(12)(I)1., and this program addresses the minimum requirements listed in 4 CSR 240-40.030(12)(I)3. and 4.

1. Subparagraph (12)(I)3.A. - Laclede is a member of Missouri One Call System, Inc. (MO One-Call). Laclede develops and annually updates a list of known excavators, identifying those who normally engage in excavation activities in areas near pipelines owned by Laclede. A file of excavators who called MO One-Call in the last year is used as a starting point for the list. Laclede has a database to track all excavator damage to Laclede facilities. This allows Laclede to ensure that all excavators who damage natural gas facilities are included on the excavator list for the next year's mailings. Municipal directories for the Saint Louis area are used to make sure that all municipalities in Laclede's service territory are also included in the mailing. In addition, the member directory of the Associated General Contractors of St. Louis is reviewed for contractors that should receive the mailing. Annual updates are provided to MO One-Call. Laclede's excavator lists for 2006 and 2005 included both the parties involved in this incident (AmerenUE and ADB Utility Contractors in St. Louis, Missouri).

2. Subparagraphs (12)(I)3.B., C., and F. - Through MO One-Call, persons listed on Laclede's excavator list are sent semi-annual mailings with damage prevention and MO One-Call information. During the twelve months prior to this incident, the MO One-Call damage prevention mailings were sent to excavators on March 28, 2006, and September 15, 2005. In addition to meeting the semi-annual notification requirement through MO One-Call, Laclede sends an annual mailing to excavators on the list that specifically addresses Laclede's damage prevention program. The 2006 mailing by Laclede was dated April 17, 2006, and was sent to AmerenUE and ADB Utility Contractors. Several topics were covered by the 2006 mailing including the topics of dig with care and safety actions that should be taken if a gas pipeline leak or damage occurs during the excavation. The safety actions topic includes reporting the leak or damage to Laclede and MO One-Call (phone numbers provided), and to call 911 in an emergency. The dig with care topic includes the following statements: "Care should always be exercised anytime you excavate around underground facilities for your safety and the safety of others. Particular care should be used to verify exact underground facility location and depth prior to the use of boring equipment and to monitor the location and depth of the boring device in relation to the facility once boring operations are commenced."

3. Subparagraph (12)(I)3.D. – MO One-Call receives and records notifications of planned excavation activities for Laclede.

4. Subparagraph (12)(I)3.E. – Laclede and MO One-Call maintain records of the excavator mailings and the excavation notifications/responses.

5. Subparagraph (12)(I)3.G. – Laclede provides for temporary marking of buried pipelines in response to excavation notifications (locate requests) received through MO One-Call. The location marking of Laclede natural gas facilities is performed by Laclede personnel or by Laclede's contract locating company, SM&P Utility Resources, Inc. (SM&P).

6. Subparagraph (12)(I)3.H[2]. and paragraph (12)(I)4.[3] - Each Laclede Construction and Maintenance Department (C&M) district office has a C&M foreman who acts as a liaison with contractors. Construction site visits are based on a variety of factors, such as when Laclede has prior notice of a contractor who plans to bore across major natural gas mains or transmission lines. When acting as a liaison, the Laclede C&M foreman will spend the day visiting construction sites to work with contractors in an effort to protect natural gas facilities.

Laclede's Damage Prevention Department

In addition to the required damage prevention program items discussed in the previous section, Laclede has a Damage Prevention Department. Three damage prevention coordinators are used to cover specific geographic areas of Laclede's service territory. The damage prevention coordinators are responsible for monitoring Laclede's damage prevention efforts, educating excavators about how to safely work around marked natural gas facilities (emphasizing how to recognize, react, and report when a natural gas facility is damaged), investigating damages, and identifying root causes when damages occur. A damage prevention coordinator attempts to have a face-to-face meeting with the excavator at the time of a damage investigation to discuss how reoccurrence could be prevented and to provide a contact to the excavator for future assistance.

The Damage Prevention Department maintains a database to track all excavator damage to Laclede facilities. From January 1, 2005 to September 11, 2006, Laclede's database contains 17 damage reports involving ADB Utility Contractors. The reasons for the damages were varied and involved a fairly even mix of root causes between Laclede and ADB Utility Contractors. One of these

---

[2] MoPSC regulation 4 CSR 240-40.030(12)(I)3.H. states that an operator's damage prevention program must "Provide as follows for inspection of pipelines that an operator has reason to believe could be damaged by excavation activities:

(I) The inspection must be done as frequently as necessary during and after the activities to verify the integrity of the pipeline; and

(II) In the case of blasting, any inspection must include leak surveys."

[3] MoPSC regulation 4 CSR 240-40.030(12)(I)4. 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."

damage reports involving ADB Utility Contractors was a broken service that was reported at 1383 Premio Drive on September 6, 2006 (six days before the incident on the same project). A Laclede damage prevention coordinator responded and found that ADB Utility Contractors had accidentally hit the service line to 1383 Premio while hand digging a pothole[4] over the service line. The pothole was being dug to expose the natural gas service line prior to horizontal directional drilling (HDD) an electric cable across the service line. Because the damage occurred while hand digging a pothole to avoid damage to the service line during the HDD work, and because Laclede encourages excavators to pothole natural gas lines that will be crossed or approached during HDD work, Laclede did not bill ADB Utility Contractors for damaging this service line.

Laclede Response to Facility Locate Request

On August 24, 2006, ADB Utility Contractors contacted MO One-Call to request facility locates in Fenton, Missouri. The locate request included the following information.

1) An electric line would be installed for AmerenUE from the transformer at 1383 Premio to 1391 Premio, and then across Premio to the electric pedestal at 1394 Premio.
2) The work involved boring using directional drill equipment (see Appendix B-1, Photograph 2).
3) AmerenUE has a temporary electric line lying on the ground (see Appendix B-1, Photograph 2).
4) The work would begin on Monday, August 28, 2006.

The response to the facility locate request was completed by Laclede's contract locating company, SM&P, on August 28, 2006. SM&P marked the natural gas and telephone lines along the project route from 1383 Premio to 1394 Premio with paint on the ground above their respective buried locations. The natural gas main and service lines were marked with yellow paint and the telephone lines were marked with orange paint.

Laclede did not schedule inspections of this excavation project on Premio Drive which involved the use of boring equipment. As noted in the **Laclede's Damage Prevention Program** section, Laclede schedules inspections when boring projects are planned near critical facilities. Laclede personnel responded to Staff that it is not uncommon to receive dozens of locate requests daily that could involve the use of directional boring equipment around distribution facilities in residential areas like this project on Premio Drive, so these projects are not scheduled for site visits. Even though an inspection was not scheduled, a Laclede damage prevention coordinator and other Laclede personnel did respond to a damaged service line that occurred during this project and observed that ADB Utility Contractors was using potholing (see discussion in **Laclede's Damage Prevention Department** section).

[4] A pothole is a hole dug by non-mechanical means (e.g., hand-dig, soft-dig with air tools) to expose an underground facility to verify its location and depth. A pothole is a method that can be used to comply with RSMo 319.037 (See Appendix C) requirement that an excavator make efforts to confirm the horizontal and vertical location of a marked underground facility when horizontal boring within the marked approximate location. The pothole allows visual confirmation that the underground facility is not damaged by the boring device.

Leakage Surveys and Leaks

No leaks were found on the most recent leak surveys of the natural gas main on Premio Drive (conducted on December 1, 2003) and the service line to 1390 Premio Drive (conducted on April 26, 2006). Three leaks were found and repaired within a one-block radius of 1390 Premio Drive within twelve months prior to the incident. Laclede's records indicate that no active leaks existed within a one-block radius of 1390 Premio Drive at the time of the incident. One of the previous leaks within a one-block radius was a broken service that was reported at 1383 Premio Drive on September 6, 2006 (see discussion in **Laclede's Damage Prevention Department** section). A Laclede C&M crew repaired the leak on September 6.

Odorization Records

Laclede conducted weekly odorant concentration tests of its natural gas systems in September of 2006. For the St. Louis County systems, the odorant concentration varied from 0.32% to 0.49% gas-in-air[5] during the week of September 4 – 10, and from 0.25% to 0.55% gas-in-air during the week of September 11 – 17. The nearest test point to Fenton was located near the intersection of Woods Mill Road and Manchester Road. The odorant concentration at this test point was 0.38% gas-in-air during the week of September 4 – 10, and 0.35% gas-in-air during the week of September 11 – 17.

Laclede Notification and Actions

Initial Notification and Response to Damaged Main

At 2:43 p.m. on September 12, 2006, a Laclede dispatcher received a report of a broken main at 1390 Premio Drive from an employee of ADB Utility Contractors. The Laclede dispatcher notified a Leak Supervisor at 2:45 p.m., and a Laclede leak truck was dispatched at 2:49 p.m. Laclede also received a "Dig-up"[6] report from MO One-Call at 2:49 p.m. for this same event, based on a call from ADB Utility Contractors to MO One-Call. A Laclede service technician was also dispatched to investigate the gas facility damage at 3:05 p.m. The explosion and fire occurred as the leak truck was arriving at the scene at approximately 3:05 p.m.

Laclede Response to the Explosion

After the explosion, the leak truck personnel requested additional assistance in responding to the emergency. The initial assessment of the scene found a horizontal directional drilling (HDD) machine across the street from 1390 Premio Drive and located between 1387 and 1391 Premio (see

[5] 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.

[6] An excavator is required by RSMo 319.045 to immediately notify MO One-Call and the owner or operator of the underground facility in the event of any damage or disturbance of any underground facility in connection with an excavation.

Appendix B-1, Photograph 2). There was an electric pedestal on the opposite side of the street in front of 1394 Premio that had a small excavation adjacent to it (see Appendix B-2, Photograph 3). There was electric cable lying on the ground along the north side of Premio Drive from 1383 to 1391 Premio (see Appendix B-1, Photograph 2). It was apparent to Laclede personnel from the sound of blowing gas that the damage had occurred near the pedestal and had been caused by the HDD operation. The leak truck personnel began the process of identifying locations of the Laclede mains, identifying safe locations away from the damage to excavate the main, and calling in emergency locate requests. A safety zone was established from Scheel Lane to 1379 Premio Drive, and all buildings in the safety zone were evacuated with assistance from police personnel (see Appendix A-2, Figure 2). The Laclede service technician arrived at 3:25 p.m. and met with a service foreman. The service foreman began turning off natural gas meters in the safety zone and the service technician began checking sewers with firemen. Sewer lids were removed at locations where natural gas readings were detected (readings were detected in both the storm and sanitary sewers). The service technician conducted leak investigations in the area to determine the extent of natural gas migration. Eight additional leak technicians arrived between 4:00 p.m. and 4:35 p.m. to assist in leak investigations and other emergency response activities. Natural gas readings were found in the entire area in front of 1390 and 1394 Premio. Natural gas readings were detected inside 1391 and 1394 Premio. After an initial reading was found inside 1394 Premio, the natural gas dissipated and no further natural gas readings were found during later investigations. Readings below the lower-explosive-limit[7] were found in the floor joists at the basement ceiling of 1391 Premio until a reading of 7.0% gas-in-air was detected at 6:00 p.m. At that time, Laclede began air jacking[8] in the front yard of 1391 Premio. The reading inside 1391 Premio had reduced to 0.05% gas-in-air at 6:30 p.m., and 0% at 7:00 p.m. (Laclede continued to monitor this reading until 2:15 a.m. on September 13). Air jacking at 1391 Premio was ended at 3:30 a.m. on September 13 after natural gas readings had cleared.

Laclede personnel made two excavations of the 2-inch diameter natural gas main in order to isolate and shutdown the damaged section of pipe. The first excavation was in front of 1454 Premio to the north of the damage location and the 2-inch polyethylene pipe was squeezed off at 3:42 p.m. The second excavation was in front of 1379 Premio to the southeast of the damage location and the 2-inch polyethylene pipe was squeezed off at 4:47 p.m. (see Appendix A-2, Figure 2). This resulted in the shutdown of the natural gas mains and service lines located between these squeeze-off locations and an outage to 15 natural gas customers. After this shutdown, the natural gas readings began to dissipate in front of 1390 and 1394 Premio. The reading at the outside foundation wall at 1394 Premio dropped from 100% gas-in-air at 5:00 p.m. to 80% at 5:30 p.m., 40% at 7 p.m., 13% at 8 p.m., 2.5% at 2:15 a.m., and 0% at 3:00 a.m.

[7] Lower-explosive-limit (LEL) is approximately 4.5% gas-in-air and represents the lower end of the flammability range for natural gas. Gas-in-air concentrations below the LEL will not ignite and concentrations above the LEL will ignite up to the upper-explosive-limit of approximately 15% gas-in-air.

[8] Air jacking is a process that uses compressed air passing through a venturi connected to a pipe. This pipe is perforated and is inserted in the ground. The device creates a vacuum to remove residual natural gas from the subsurface atmosphere and disperses it into the above ground atmosphere.

The natural gas service line to 1390 Premio was abandoned at the main. At approximately 9:45 p.m., natural gas was restored to the shutdown mains except for an isolated section that included the damaged main in front of 1390 and 1394 Premio. This allowed for service to be restored to most of the natural gas customers that had been affected by the shutdown. The damaged section of 2-inch polyethylene pipe was removed and replaced on September 13.

An odorometer reading was taken by Laclede laboratory personnel at approximately 5:40 p.m. on September 12 at the riser to 1375 Premio Drive. The odorant was readily detectable at 0.40% gas-in-air (it was readily detectable at a concentration less than 0.90% gas-in-air, as required).

Missouri Public Service Commission Investigation

Missouri Public Service Commission Reporting Requirements

The incident reporting requirements in 4 CSR 240-40.020(3) and (4) were completed as follows:

1. The initial telephone notification of a possible natural gas incident was made to a Staff member at 3:45 p.m. on September 12, 2006.
2. Laclede notified the United States Department of Transportation-Pipeline and Hazardous Materials Safety Administration (DOT-PHMSA) of a natural gas incident on September 12, 2006. (NRC Report Number 811217).
3. DOT-PHMSA form PHMSA F 7100.1 titled "Incident Report – Gas Distribution System" was completed by Laclede and submitted to Staff on October 12, 2006. The Staff forwarded the report to DOT-PHMSA on October 25, 2006.

Incident Site Investigation

Two members of the Staff traveled to Fenton and arrived at the incident site at approximately 8:00 p.m. on September 12, 2006. The home at 1390 Premio Drive had been completely destroyed and the fire was extinguished. Staff spoke with several of Laclede's supervisors who described the events that had occurred and the actions taken up to that point. The Staff observed actions that were continuing to occur, such as leak investigations, air jacking, and service restorations. Due to darkness, Staff delayed further investigation until the next morning and left the incident site at approximately 9:45 p.m.

Upon arrival the next morning, Staff again noted the complete destruction of the home at 1390 Premio (see Appendix B-1, Photograph 1). Staff noted the horizontal directional drilling (HDD) machine used by ADB Utility Contractors was located between 1387 and 1391 Premio (see Appendix B-1, Photograph 2). Staff learned that ADB Utility Contractors was hired by AmerenUE to install an underground electric cable beneath Premio Drive. The boring rod was traversing from the east side of the street toward an electric pedestal on the west side of the street and in front of 1394 Premio. The electric pedestal was located between the sidewalk and curb, and had a small excavation next to it (see Appendix B-2, Photograph 3). Staff observed white markings on the street pavement. After discussions with Laclede and ADB Utility Contractors personnel, Staff

learned that the HDD crew had been tracking the boring drill head by painting white marks on the street surface above the drill head location as it crossed underneath the street (see Appendix B-3, Photograph 4). Staff also noticed that the natural gas main that ran along the west side of the street had not been exposed (or potholed) prior to the horizontal boring operation.

Much of the house at 1390 Premio had fallen into the basement and received extensive fire damage. Large sections of the exterior walls were lying in the yard near to the foundation. Additional debris was scattered across the surrounding yard and even into the street. A vehicle with extensive fire damage was observed in the garage. The two adjacent homes also had melted siding on the respective sides that faced 1390 Premio.

During the morning of September 13, Laclede personnel began an excavation over the natural gas main to expose the damage to the pipe and expose the boring drill head. The excavation included the use of both a backhoe and hand digging. The top of the main was approximately 32 inches below the ground surface. After the natural gas main was exposed, the damage to the pipe was apparent. The drill head had bored through the bottom half of the natural gas main (see Appendix B-4, Photograph 5). Representatives from Laclede, ADB Utility Contractors, and SM&P were on hand to witness the excavation and to check the accuracy of the locate marks. The horizontal distance between the 2-inch natural gas main and the locate paint marks was approximately 3 inches at the damage location. The Staff measured the distance from a white dot on the driveway to the main damage as approximately 36 inches. This white dot was indicated by ADB Utility Contractor personnel as the furthest location to the west of the drill head as indicated by their electronic locating device (see the **ADB Utility Contractors Information** section). The damage to the main was approximately 50 feet north of the northeast corner of the house at 1390 Premio.

AmerenUE Information

AmerenUE is the electric utility for the St. Louis Metro Area, including the neighborhood around 1390 Premio Drive. Electric cables had previously been installed under the street between 1387 and 1394 Premio Drive. On July 31, 2006, some customers on Premio Drive informed AmerenUE that they were experiencing power problems. AmerenUE personnel determined that one cable of the underground secondary cable running under Premio Drive had failed. The customers at 1390, 1394, and 1398 were affected by the cable failure. An AmerenUE troubleman installed a temporary aboveground cable on July 31 to maintain power to the affected residences. The temporary cable ran from the transformer at 1383 Premio Drive, along the sidewalk to a tree in front of 1391 Premio Drive, across the street in the tree tops, and back down into the pedestal between 1390 and 1394 Premio Drive (see Appendix B-1, Photograph 2). On August 9, 2006, an AmerenUE crew was sent to the site to repair the faulted cable. This same piece of cable also had a cable fault previously on March 23, 2006. Since this was the second fault on the cable and the cable appeared “spongy” at the point of fault, the crew decided that the cable needed to be replaced with a new underground cable. ADB Utility Contractors was assigned by AmerenUE to directional bore and install a 3-inch diameter polyethylene conduit underneath the street for the new electric cable. The directional boring by ADB Utility Contractors began on September 6, 2006.

AmerenUE has performed formal safety audits of ADB Utility Contractors a minimum of 20 times per year to check that their directional borings are being performed safely. AmerenUE also has a supervisor whose sole responsibility is to oversee directional boring work being performed. Between 60 and 70% of the supervisor's time is spent out in the field, directly involved with directional boring projects. AmerenUE does not instruct ADB Utility Contractors as to emergency procedures when natural gas facilities are damaged.

In a letter to the Chairman of the Missouri Public Service Commission dated January 4, 2007, AmerenUE responded to a request from the Commission to offer potential actions that AmerenUE could take to improve the reliability of electric service, in particular during severe weather events. [The letter is available on the Ameren website and has been filed by the Commission in MoPSC Case No. ER-2007-0002.] Attached to this letter was a listing of twelve possible approaches to improve customer reliability in severe storms, including Approaches 1 - 3 that could be started quickly and Approaches 4 - 12 that require further development and consideration. Approaches 4 - 7 involve placing distribution facilities and customer services underground (see Appendix D). The second paragraph of Approach 4 states:

> As of March 2006, AmerenUE had 26,800 miles of distribution overhead circuits with voltages between 1kV and 100kV and 6,600 miles of underground circuits of the same voltage classes – about an 80/20 mix. Over the past two years, AmerenUE has installed an average of 106 miles of overhead circuits annually compared to 262 miles of underground circuits – a 30/70 mix. From a new construction standpoint in terms of number of miles, AmerenUE is already predominately an "underground" utility. The possible approach here would be to extend that to 100% underground for new distribution facilities. However, it is important to note that the remaining 30% will predominately be 3-phase circuits, many along roadways that will be more expensive to construct.

ADB Utility Contractors Information

On September 13, the Staff discussed the incident with the project manager for ADB Utility Contractors who was managing this project and had discussed the events with the crew. The crew left the shop at 7:00 a.m. on September 12 and proceeded to Premio Drive to start the street bore. The horizontal direction drilling (HDD) machine uses drilling rods to push a drill head through the ground (fluid is also injected at the drill head to assist with the drilling process). The drill head was about 2 feet long and had a 3.5-inch to 4-inch bill[9] with a 12-degree curve (see Appendix B-5, Photograph 6). The drill head contains a beacon that transmits a signal that can be tracked with an electronic locating device. It is ADB Utility Contractors' practice (not documented) to calibrate the drill head beacon and locator each morning with two checks. The first check is for horizontal measurement. The drill head is placed on the ground and a ten-foot tape is extended laterally from the drill head, and the locator is placed at the end of the tape and adjusted as necessary to 120

[9] The bill is a flat steel blade with carbide tips. The curve of the bill is what allows the machine operator to change the direction of the drill head.

inches. The second check is for depth measurement. The locator is held 36 inches above the drill head on the ground and adjusted as necessary.

The HDD path across the street was intended to end in the target hole (approximately four feet by eighteen inches by two feet) next to the pedestal (see Appendix B-5, Photograph 7). The crew did not dig a pothole over the natural gas main because it was on the other side of the pedestal and they intended to stop in the target hole on the street side of the pedestal. If they had completed a drilling path across the street as intended, they were going to back-ream with a 6-inch reamer to pull in the 3-inch polyethylene pipe that is used as a conduit for the electric cable. AmerenUE was to make the tie-in for the electric cable at the pedestal and transformer when they were done.

The drill head was halfway across the street at 12:00 or 12:30 p.m. The white dots and numbers on the street are location and depth of the drill head as indicated by the locator (see Appendix B-3, Photograph 4). The drill head was across the street at approximately 1:30 p.m., and the crew went to lunch. The locator said the drill head was at the edge of the driveway instead of at the pedestal. The project manager pointed out the white dot at the edge of the driveway where the crew thought the drill head was located. They returned to the job at approximately 2:00 p.m. and pulled back twelve feet (2 rods). They then started drilling again and tried to make the drill head move toward the pedestal. They had gone about ten feet when they started smelling gas. They stopped the drill head and left it in the position where it was found on September 13. The project manager indicated it was evident that the drill head had gone back in the same hole instead of moving toward the pedestal. They called a field supervisor for ADB Utility Contractors at approximately 2:37 p.m. to report this. This information was called in to Laclede, and then to MO One-Call. At about 2:45 – 2:50 p.m., they knocked on doors and told homeowners to leave. The crew leader knocked on the door to 1390 Premio. The explosion occurred at approximately 3:03 p.m. and none of the ADB Utility Contractor personnel were injured.

The project was called into MO One-Call to request locates, and they had a locate ticket dated August 28. The crew had hit a service line on September 6 during this project when they were potholing with a shovel. The damage occurred because the hand digging was very tough due to rocks and roots. The Laclede damage prevention coordinator said ADB Utility Contractors would not be charged since they were hand digging and to give them an incentive to hand-dig and pothole. ADB Utility Contractors has a pothole policy in their employee manual that includes a three-day suspension for the first occurrence of a preventable hit due to not potholing.

Resident Information

The resident of 1390 Premio Drive who was home prior to the explosion indicated he had been sleeping. He woke up and did not smell gas since the bedroom door was closed. He opened the door and walked down the hallway. He smelled gas and it got worse as he walked down the hall. He went down stairs and it was very strong. He opened the front door and saw two guys frantically digging with shovels by the pedestal. They were hitting rocks and there was a hissing gas sound. They told him they had already called Laclede. He asked if he needed to get out of his house. They

told him that he might want to get some fresh air. He noticed the strongest gas smell by the laundry room. He went to the back yard fence and called his wife, and they agreed he should leave. He got his keys to the van in the garage, but didn't start it due to the gas odor. He went around to leave and noticed one of the two guys was shutting off his gas. He let his dog out and saw the two guys walking away when he left. He went to his truck that was outside and was driving away when he saw his house explode in the rear view mirror.

A resident at 1391 Premio Drive indicated they had problems with their electric service a few times over the past couple of years. After the last problem, a temporary cable was installed. The contract crew was boring in a new electric cable and hitting a lot of rocks. They hit another gas line last week. During the morning, a crew of about five guys were boring under the street and marking as they went across the street. The hole next to the pedestal was started (see Appendix B-2, Photograph 3), and then about an hour before the explosion, two guys started digging it out with shovels to get it deeper. He noticed later that they quit digging and started knocking on doors. They did not stop at his house. One guy was knocking on 1394 and 1398 Premio, and had a wrench trying to cut off the meters. Another guy was knocking at 1387 Premio when the explosion occurred. He was in the back of his house when the explosion occurred. He had smelled a slight odor of gas, but was not as concerned since they had hit a line last week.

A resident at 1387 Premio Drive indicated that a young man with the work crew knocked on her door to tell her he had turned off her gas meter. While they were talking at the front door, the house at 1390 Premio exploded and there was a fireball in front of the house. She called 911.

Past Incidents Involving Horizontal Boring

The Staff has investigated and filed reports on past incidents involving excavations that were using horizontal boring equipment.

A report was filed in Case No. GS-2000-525 for an incident that occurred on February 7, 2000, in Barnhart, Missouri. A Laclede natural gas main was struck during the installation of a telephone cable using horizontal drilling equipment. The polyethylene main had not been potholed. A residence was destroyed by a natural gas explosion, which caused damage to numerous other residences/vehicles and a Laclede employee sustained fatal injuries.

A report was filed in Case No. GS-2001-216 for an incident that occurred on July 24, 2000, in Warrensburg, Missouri. A natural gas service line was struck during the installation of a telephone cable using horizontal boring equipment. A residence was damaged by a flash fire and a resident sustained burn injuries.

A report was filed in Case No. GS-2000-133 that discusses a natural gas main damage on July 27, 1999 in Kansas City, Missouri. The polyethylene main was struck during the installation of a telephone cable using horizontal drilling equipment, and the main had not been potholed. Natural gas migrated into several structures and they were evacuated.

A report was filed in Case No. GS-2000-62 for an incident that occurred on July 6, 1999, in Kansas City, Missouri. A steel gas service line was struck during the installation of a telephone cable using horizontal boring equipment. A worker sustained burn injuries when a flash occurred in a communications manhole.

The Staff received a telephonic notification on October 11, 2006, that a natural gas main was struck during the installation of a television cable using horizontal boring equipment in Salisbury, Missouri. The steel main had not been potholed. An outage of 15 customers occurred and natural gas accumulated in a building.

The Staff is also aware that horizontal boring equipment has been involved in other natural gas incidents around the country, including one that was investigated by the National Transportation Safety Board (NTSB) and reported on in NTSB Report PAB-99-02. NTSB has also made Safety Recommendations in multiple accident reports that involved excavator damage that the excavator should call 911 when damage occurs to a natural gas facility in addition to calling the gas company.

New Federal Law Regarding Damage Prevention

A copy of a portion of the Pipeline Inspection, Protection, Enforcement and Safety (PIPES) Act of 2006 is attached in Appendix E. This reauthorization of the Federal Pipeline Safety Law was passed in Congress on December 7, 2006, and signed into law by the President on December 29, 2006. In addition to new federal damage prevention requirements that are similar to RSMo Chapter 319, there is a new Federal requirement to call 911 in addition to the pipeline operator when gas is escaping from a damaged pipeline.

Commission Safety Requirements for Electric and Telecommunication Cables

The Missouri Public Service Commission rule 4 CSR 240-18.010 (as amended, effective April 30, 2004) prescribes minimum safety standards relating to the operation of electric utilities, telecommunication companies and rural electric cooperatives. Section (1) adopts portions of the 2002 Edition of the National Electric Safety Code (NESC), including Part 3 that contains safety rules for underground electric and communication lines. Rule 320B5 in the NESC for underground conduit systems states that "Conduit should have sufficient separation from gas and other fuel lines to permit the use of pipe maintenance equipment." Rule 351A4 in the NESC for direct-buried cable states that "The location of structures in the path of the projected cable route shall, as far as practical, be determined prior to trenching, plowing, or boring operations." Rule 354A2 in the NESC for direct-buried cable states that "Radial separation of supply and communications cables and conductors from steam lines, gas, and other fuel lines shall be not less than 300 mm (12 in) and shall meet Rule 353." Additional standards for the design, construction and operation of telecommunication facilities are prescribed in 4 CSR 240-32.060. In addition to these Commission requirements, the excavator who is installing underground electric or telecommunication cables is required to follow the underground damage prevention law in RSMo 319.010 through 319.050.

ANALYSIS

Third Party Damage to the Natural Gas Main

Prior to installing a new underground electrical line for Premio Drive, ADB Utility Contractors called MO One-Call to request that underground facilities be marked in the vicinity of the proposed electrical cable installation. On August 28, 2006, the natural gas and telephone facilities in the area of the proposed work were located and marked, including the 2-inch diameter natural gas main on the west side of Premio Drive in front of 1390 and 1394 Premio. After the incident, it was verified that the yellow paint marks on the ground and driveway near to the location of the natural gas main damage accurately marked the approximate location[10] of the natural gas main.

Prior to September 12, 2006, ADB Utility Contractors used HDD equipment to horizontally bore and install 3-inch diameter conduit from the transformer at 1383 Premio to the yard in front of 1387 Premio. On September 6, ADB Utility Contractors damaged the natural gas service line to 1383 Premio while hand digging a pothole to expose the service line. This service line damage was reported to Laclede, and a Laclede damage prevention coordinator observed that the damage occurred during hand digging of a pothole. This demonstrates that ADB Utility Contractors was aware that they needed to expose the natural gas service line that was to be crossed by the HDD boring path (required by RSMo 319.037). In addition to the statutory requirement, ADB Utility Contractors personnel indicated they have a policy to pothole marked facilities in their employee manual that includes employee discipline for non-compliance.

ADB Utility Contractors was using HDD equipment on September 12 to horizontally bore and install 3-inch diameter conduit beneath Premio Drive. A target hole was excavated next to the electric pedestal and toward the street curb. The natural gas main was marked between the pedestal and sidewalk and was not potholed. ADB Utility Contractors personnel indicated they did not pothole the natural gas main because they intended to stop at the target hole and the natural gas main was on the other side of the pedestal. The location of the drill head crossing beneath the street was tracked with an electronic locating device, and the location and depth of the drill head as indicated by the electronic locating device was painted on the street surface. The marked path of the drill head did not go to the target hole, but instead was indicated to be deeper than the target hole and beneath the edge of the driveway for 1390 Premio. The driveway edge was several feet away from the electric pedestal and a few feet away from the curb side of the target hole. It was not determined why the path was off target, but the rocky soil probably made it difficult for the HDD equipment operator to guide and redirect the drill head. ADB Utility Contractors personnel indicated that they realized they were not on target, pulled back two rods (twelve feet), started drilling again, and tried to redirect the drill head to the target hole. A natural gas odor was detected and this was reported to Laclede and MO One-Call.

[10] "Approximate location" is defined as “a strip of land not wider than the width of the underground facility plus two feet on either side thereof” in RSMo 319.015.

The distance between a white dot on the driveway and the natural gas main damage was approximately 36 inches. The white dot is the location that ADB Utility Contractors personnel indicated that the drill head was at when they stopped the first time, before pulling back 2 rods. Instead of being located at the white dot, the drill head had actually drilled through the natural gas main to some point past the natural gas main. Since ADB Utility Contractors personnel indicated that they calibrate the electronic locating device with the drill head each morning and that they normally can accurately track the drill head, it was not clear why this error between the white dot and main locations occurred. The Staff does not have any information regarding any subsequent testing of the electronic locating device. The reason for the difference in the actual location of the drill head and the location indicated by ADB Utility Contractors personnel was not determined.

Natural Gas Escape and Migration

The natural gas escaping from the damaged 2-inch diameter main would have exited with a pressure of approximately 36 psig (estimated operating pressure by Laclede). When the natural gas main was first damaged at about 1:30 p.m., the drill head was located in the bottom half of the natural gas main and would have somewhat limited the amount of natural gas escaping from the main. Based on the information from ADB Utility Contractors, they pulled the drill head back twelve feet at about 2:00 p.m. The hole in the bottom half of the natural gas main would have allowed the natural gas to escape at a high flow rate. This high flow of escaping natural gas continued until the natural gas main was squeezed off after the explosion. The hole in the natural gas main was about 50 feet north of the northeast corner of the structure at 1390 Premio.

Natural gas escaping from an underground pipe tends to migrate along paths of least resistance through the soil and upward through the soil. Since natural gas is lighter than air (natural gas has specific gravity of 0.6 while air has a specific gravity of 1.0), it tends to migrate upward into the atmosphere where possible. Some factors that influence how fast the natural gas will migrate and the direction of migration are the pressure of the natural gas in the pipe, the flow rate of the escaping gas, and the consistency of the soil. The rocks and clay-type soil (which is composed of fine particles and has small voids) over the gas main would have limited the upward migration of the natural gas through the soil. The precipitation received in the day before the incident would also create a resistance to the upward migration of the escaping natural gas by filling the pore spaces of the soil near the soil surface. Additionally, the depth of cover of the natural gas main and nearby concrete sidewalk would also create a resistance to upward migration and venting of the natural gas to the atmosphere.

With this limited migration, the natural gas was somewhat confined underground and would tend to migrate laterally along paths of least resistance. The bore hole in the soil between the main and the pulled-back drill head was the path of least resistance, but the soil, drill head, and drilling fluid would have somewhat confined this path. Another migration path was through the backfill along the natural gas main along Premio Drive. Burned grass provided evidence that natural gas had vented and burned along the natural gas main in front of 1390 and 1394 Premio, and along the natural gas service line to 1394 Premio.

Once the natural gas migrated along the natural gas main to beneath the driveway for 1390 Premio, another migration path would be through the base rock and voids beneath the concrete driveway and in the uphill direction towards the structure. The concrete driveway would have limited venting of the natural gas into the atmosphere to the edges of the driveway. Burned grass along the driveway edges indicated there was natural gas migration along this path.

Natural Gas Entrance, Accumulation, and Ignition

The Staff did not determine where the natural gas entered 1390 Premio Drive, but it may have traveled through one, or a combination, of several entry avenues. Natural gas migrated through the soil to the foundation and could have then migrated under the foundation and beneath the basement and garage floors. Natural gas could have entered the basement and garage of 1390 Premio through cracks in the concrete foundation and floor, or through the juncture of the floor with the foundation walls. Another possible path and entrance into 1390 Premio would have been through the sanitary sewer system if a drain trap in the structure was dry or missing.

Natural gas entering the structure at 1390 Premio accumulated to an explosive mixture. The explosion occurred when a mixture of natural gas and air in the explosive range (4.5% to 14.5% gas-in-air by volume) was ignited. The natural gas water heater or furnace could have provided the ignition source. Additionally, electrical and telephone devices would have been present at various locations in the structure and were possible ignition sources. The specific source of ignition was not determined. A fire that was fed by natural gas continued after the explosion and caused much of the fire damage.

Laclede's Emergency Response and Actions

Laclede responded to the report of a damaged main immediately and a Laclede leak truck arrived in approximately 22 minutes. The explosion occurred as they arrived, and additional personnel responded to the incident. Service technicians conducted testing for natural gas around Laclede facilities, neighboring homes, and in nearby sanitary and storm sewers to find the extent of migration of the leaking natural gas. After a safety zone was established and adjacent homes were evacuated, Laclede personnel identified areas that were safe distances away from the damage location to excavate. Laclede personnel excavated and squeezed off the 2-inch natural gas main in front of 1454 Premio Drive and 1379 Premio Drive. The leaking gas was shut off at 4:47 p.m. Laclede continued to check for gas readings in and around the surrounding homes of the incident. Laclede found gas readings at 1391 and 1394 Premio and took actions to monitor and clear the readings. Air jacking was required to clear out residual natural gas near the residences and was continued until there were no sustained gas readings at 3:30 a.m. on September 13, 2006. Laclede's response actions followed their emergency procedures and addressed the unsafe situation that continued to exist after the explosion.

Compliance with Chapter 319 of the *Missouri Revised Statutes*

ADB Utility Contractors complied with the requirement to call MO One-Call prior to the excavation (RSMo 319.025). Laclede complied with the requirement to mark the approximate location of the natural gas main and service lines (RSMo 319.030). When ADB Utility Contractors damaged the natural gas service line to 1383 Premio on September 6, 2006, they were trying to comply with requirement to confirm the horizontal and vertical location of the service line before horizontal boring within the marked approximate location of the service line (RSMo 319.037). After the natural gas main was damaged on September 12, 2006, ADB Utility Contractors complied with the requirement to report the damage to Laclede and MO One-Call (RSMo 319.045).

ADB Utility Contractors did not pothole the natural gas main on September 12, 2006, but the curb side of the target hole next to the electric pedestal was not in the approximate marked location of the natural gas main. An excavator is not required by RSMo 319.037 (see Appendix C) to determine the horizontal and vertical location of a facility if the horizontal boring is not used within the approximate marked location of that facility. As evidenced by the damage to the natural gas main, ADB Utility Contractors did use horizontal boring in the approximate location of the natural gas main without determining the main's horizontal and vertical location. Thus, it appears that ADB Utility Contractors did not comply with RSMo 319.037 on September 12, 2006. However, ADB Utility Contractors indicated that they thought the drill head was at a location that was measured by the Staff to be approximately 36 inches away from the natural gas main.

Possible Actions that Could Have Prevented the Incident

If the method and electronic locating device (locator) used by ADB Utility Contractors to track the drill head location had been accurate and used throughout the entire drilling length, then ADB Utility Contractor personnel should have known to stop drilling before reaching the approximate location of the natural gas main. This also could have been confirmed by potholing the drill head location at the curb line. If the drilling head had been pulled back sooner and redirected to the target hole at the pedestal, and if the target hole was dug as deep as the drill head, then the drill head would have entered the target hole and could have been detected even if the drill head had gone farther than indicated by the locator. Another action that could have detected a substantial difference in length of the drill path would be to measure the length of the drill path by the number of 6-foot rods used.

Laclede's Damage Prevention Program

Laclede has a substantial damage prevention program that exceeds the minimum requirements regarding excavator education and damage tracking. Laclede has a damage prevention department and damage prevention coordinators, which are not required. Laclede's program does not appear to exceed the minimum requirements for identifying excavations for inspection and conducting excavation inspections. Due to the large volume of excavations that occur near Laclede facilities each day, Laclede normally inspects only those excavations that are near critical facilities such as

transmission lines or major natural gas mains. Most of Laclede's facilities are not considered "critical". Therefore, most excavations are not inspected by Laclede.

The locate request by ADB Utility Contractors for Premio Drive involved installation of electric conduit and cable using directional drilling equipment across several properties and the street. The project began on September 6 and was still in progress on September 12. Horizontal boring projects of this size and larger involve some of the factors (see parentheses below) in 4 CSR 240-40.030(12)(I)4., which should be considered when reviewing locate requests to determine the need for and the extent of inspections. The horizontal boring project will take multiple days, so the duration is more than a small one or two-day job (type and duration of the excavation activity). The project involves the use of horizontal boring equipment, which is more of a concern because of the need for potholing, the increased potential for an incident since any damage is not vented to the atmosphere, and the increased potential for damage that is not noticed by the equipment operator (type of equipment, the potential for serious incident should damage occur, and the potential for damage occurring which may not be easily recognized by the excavator). The Staff believes that significant horizontal boring projects are the type of excavation projects that a natural gas system operator should identify for one or more inspection visits during the project, especially if the excavator has a previous history of damaging the operator's facilities. "The prior history of the excavator with the operator" is another factor listed in 4 CSR 240-40.030(12)(I)4., which should be considered when reviewing locate requests to determine the need for and the extent of inspections. Laclede maintains a database to track all excavator damages that could be used for this purpose.

Installation of Electric and Telecommunication Cables

The Missouri Public Service Commission regulates safety for electric utilities, telecommunication companies and rural electric cooperatives. They must install underground cables and conduits in accordance with the Commission's rules. The excavator who installs these underground cables and conduits needs to comply with the damage prevention law in RSMo 319.10 through 319.050. This includes compliance with RSMo 319.037 (see Appendix C) when horizontal boring is used to install the cable or conduit.

There have been multiple instances of natural gas incidents that have occurred when a natural gas pipeline was damaged during or after the installation of an underground conduit or cable using horizontal boring. This incident is the most recent example. After the conclusion of Case No. GS-2000-525, a Staff letter was sent to electric utilities, telecommunication companies and rural electric cooperatives in June of 2001 to remind these entities of their obligations under RSMO Chapter 319 and the Commission rules. It would be appropriate for the Commission to advise electric utilities, telecommunication companies and rural electric cooperatives of this incident and the need to follow the safety requirements in the Commission's rules and RSMo 319.10 through 319.050. Specific attention should be drawn to RSMo 310.037 and the requirement to confirm the horizontal and vertical location of the natural gas facility when using horizontal boring within the marked approximate location of such natural gas facility. Based on this incident, it would also be appropriate for the Commission to recommend that the horizontal and vertical location of a natural

gas facility also be confirmed when the horizontal boring will approach or be in the vicinity of the marked approximate location of such natural gas facility, or confirm that the boring tool is outside the marked approximate location. The Staff letter that was sent in June of 2001 could provide a starting point for such a letter or notice by the Commission.

AmerenUE Installation of Underground Electric Cables

About 70% of new electric cable installations by AmerenUE are installed underground, with an annual average of 262 miles of underground circuits installed in the past two years. AmerenUE will be continuing to install underground circuits and is considering increasing the underground versus overhead installation of new distribution facilities from 70% to nearly 100%. AmerenUE is also considering whether additional efforts should be undertaken to put new customer service lines underground and whether to put any existing overhead circuits and service lines underground.

AmerenUE performed safety audits of horizontal boring projects by ADB Utility Contractors, and has a supervisor assigned to supervise horizontal boring projects. AmerenUE is responsible for ensuring that its electric cables are installed in accordance with the Commission's rules. Based on this incident and the continued, and possibly increasing, installation of underground electric cables, it would be appropriate for AmerenUE to review its procedures and practices for inspecting installations by contractors.

APPENDIX A
(Figures)

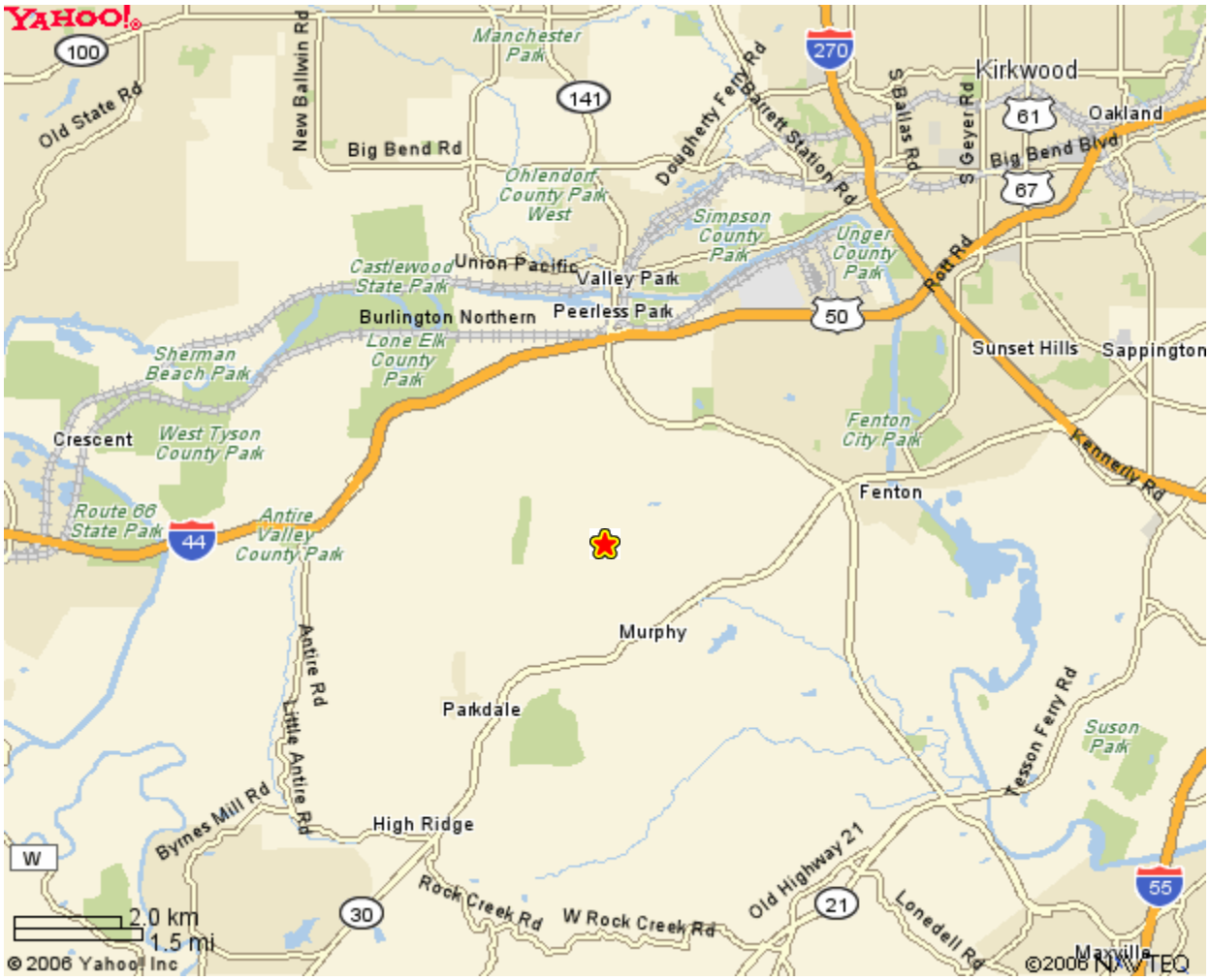
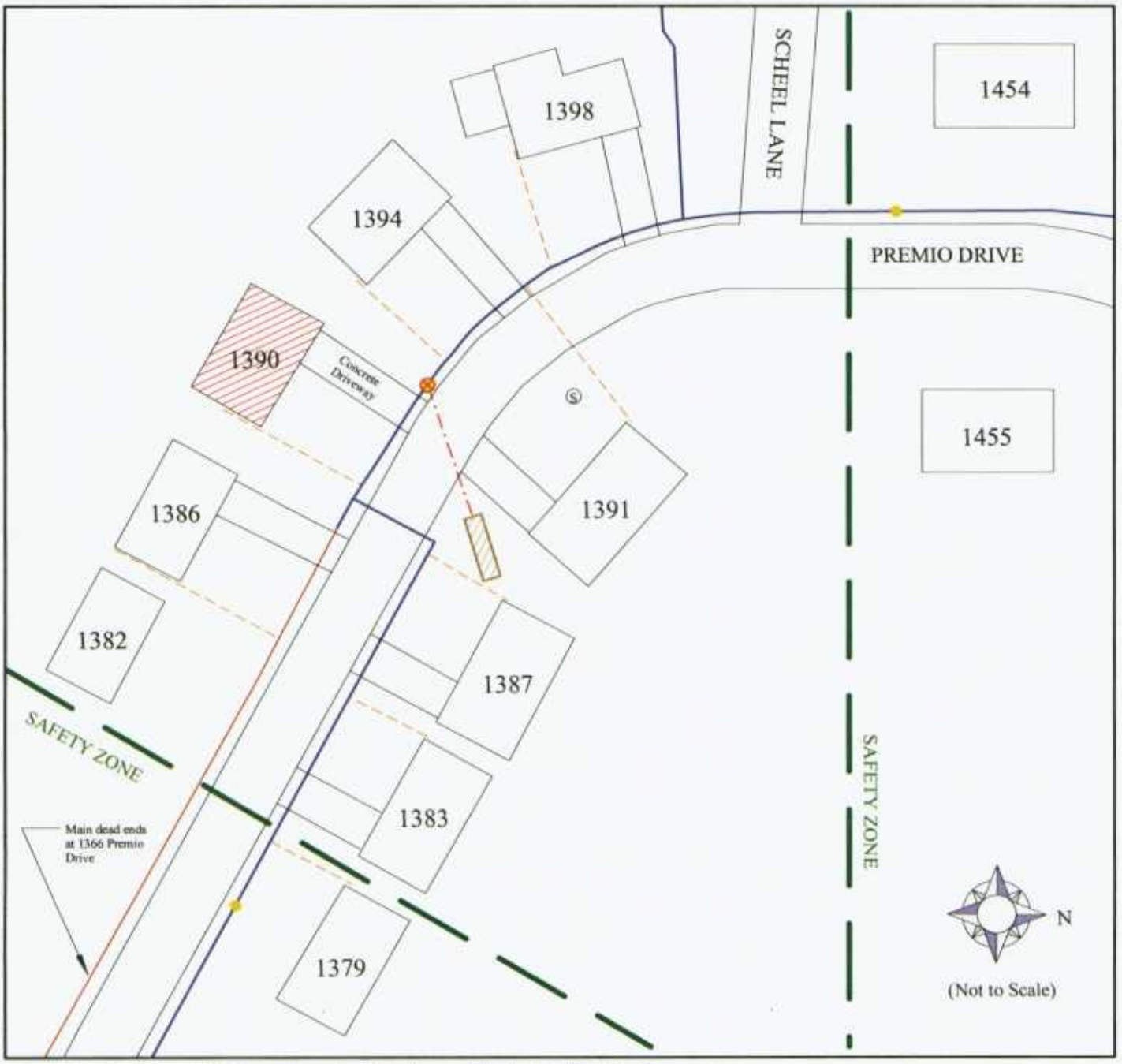


Figure provided by Yahoo! Maps

Overall location of 1390 Premio Drive with respect to the surrounding highways.

Figure 1
Overall View of Incident Location
Appendix A-1



(Note: Drawing was modified from the orginal drawing provided by Laclede Gas Company)

Map Legend

- 2-inch diameter plastic natural gas main
- 1¼-inch diameter plastic natural gas main
- Natural gas service line
- Incident location at 1390 Premio Drive (refer to Photograph 1 within Appendix B-1)
- ADB Utility Contractors boring machine (refer to Photograph 2 within Appendix B-1)
- Bore rod path (refer to Photograph 4 within Appendix B-3)
- Damage location (refer to Photograph 6 within Appendix B-4)
- Squeeze-off location
- Ⓢ Sanitary sewer manhole

Figure 2
Plan Site View Along Premio Drive
Appendix A-2

APPENDIX B
(Photographs)

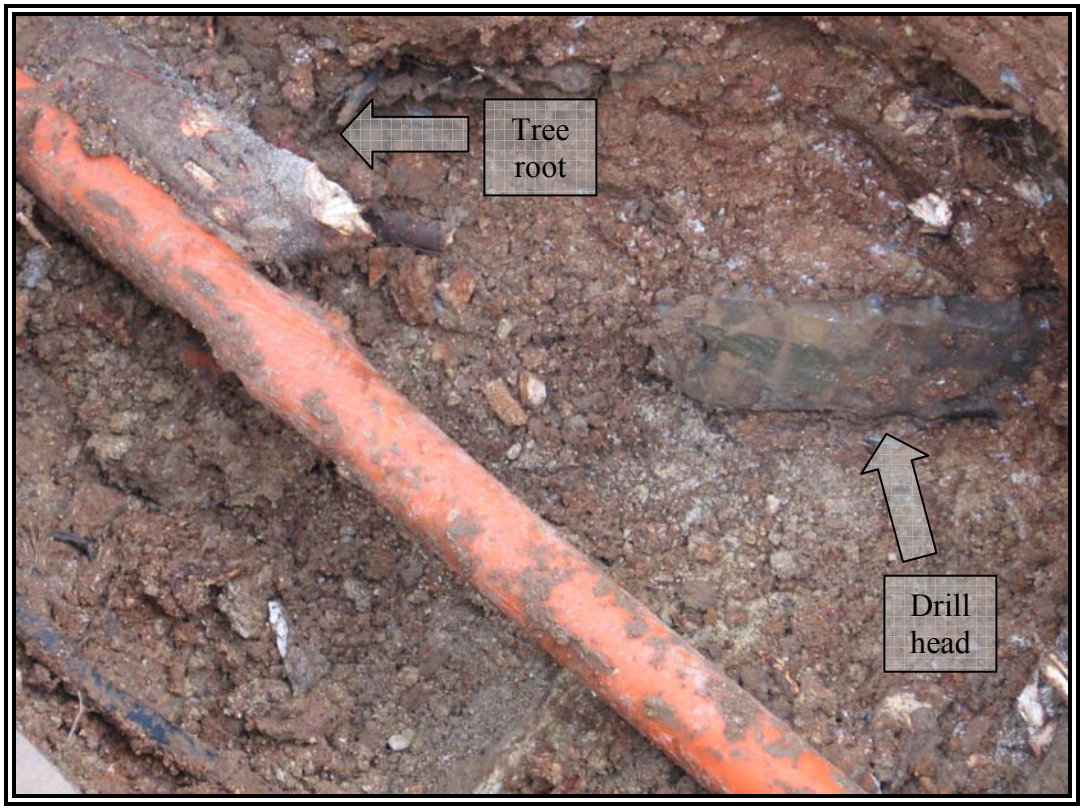
Photograph 1 View looking southwest at the scattered debris from 1390 Premio Drive. Note the burned grass along the curb in front of the house and along the driveway.

Photograph 2 View looking west at boring equipment used by ADB Utility Contractors. Note the temporary electric cable running along the sidewalk and across the street in the trees.

Photograph 3 View of temporary electric cable connecting to the electric pedestal. Note shallow excavation dug by ADB Utility Contractors (intended target for drill head).

Photograph 4 View looking west along the boring path for ADB Utility Contractors. Note the markings on the street which are the locations and depths (in.) of the drill head as marked by ADB Utility Contractors.

Photograph 5 Close-up view of damage to underside of 2-inch diameter polyethylene main.



Photograph 6 Close-up view of exposed damaged natural gas main and drill head. Note the tree root growing alongside the gas main.

Photograph 7 Overhead view of exposed damaged natural gas main and the drill head that hit the line. Note the electric pedestal and the shallower target hole to the left that was excavated by ADB Utility Contractors.

APPENDIX C

(Section 319.037 of the *Missouri Revised Statutes*)

Missouri Revised Statutes

Chapter 319
General Safety Requirements
Section *319.037*

August 28, 2006

Excavation sites included in requirements--equipment prohibited at such sites.

319.037. 1. Notwithstanding any other provision of law to the contrary, the procedures and requirements set forth in this section shall apply on the site of any excavation involving horizontal boring, including directional drilling, where the approximate location of underground facilities has been marked in compliance with section 319.030 and where any part of the walls of the intended bore are within the marked approximate location of the underground facility.

2. The excavator shall not use power-driven equipment for horizontal boring, including directional drilling, within the marked approximate location of such underground facilities until the excavator has made careful and prudent efforts to confirm the horizontal and vertical location thereof in the vicinity of the proposed excavation through methods appropriate to the geologic and weather conditions, and the nature of the facility, such as the use of electronic locating devices, hand digging, pot holing when practical, soft digging, vacuum methods, use of pressurized air or water, pneumatic hand tools or other noninvasive methods as such methods are developed. Such methods of confirming location shall not violate established safety practices. Nothing in this subsection shall authorize any person other than the owner or operator of a facility to attach an electronic locating device to any underground facility. For excavations paralleling the underground facility, such efforts to confirm the location of the facility shall be made at careful and prudent intervals. The excavator shall also make careful and prudent efforts by such means as are appropriate to the geologic and weather conditions and the nature of the facility, to confirm the horizontal and vertical location of the boring device during boring operations. Notwithstanding the foregoing, the excavator shall not be required to confirm the horizontal or vertical location of the underground facilities if the excavator, using the methods described in this section, excavates a hole over the underground facilities to a depth two feet or more below the planned boring path and then carefully and prudently monitors the horizontal and vertical location of the boring device in a manner calculated to enable the device to be visually observed by the excavator as it crosses the entire width of the marked approximate location of the underground facilities.

(L. 2001 H.B. 425)

APPENDIX D

(Excerpt from Attachment A to the AmerenUE letter dated January 4, 2007)

Approaches That Require Further Development/Consideration

4. Modify AmerenUE Tariff to Reflect Underground Imperative

Change the approach to all future construction on the distribution system to require underground installation versus the combined overhead/underground approach used today. Currently, new 3-phase facilities are typically built using overhead construction unless there are engineering reasons for placing them underground or if another party pays for the difference in cost. New subdivision facilities are installed underground. This policy would be changed to require that all new distribution facilities are buried as the preferred method unless there are overriding engineering reasons to the contrary.

As of March 2006, AmerenUE had 26,800 miles of distribution overhead circuits with voltages between 1kV and 100kV and 6,600 miles of underground circuits of the same voltage classes – about an 80/20 mix. Over the past two years, AmerenUE has installed an average of 106 miles of overhead circuits annually compared to 262 miles of underground circuits – a 30/70 mix. From a new construction standpoint in terms of number of miles, AmerenUE is already predominately an "underground" utility. The possible approach here would be to extend that to 100% underground for new distribution facilities. However, it is important to note that the remaining 30% will predominately be 3-phase circuits, many along roadways that will be more expensive to construct.

5. Implement a Program to Place Existing Overhead Distribution Facilities Underground

Systematically start replacing a certain amount of the existing 26,800 miles of overhead circuits with underground circuits. Analysis would be required to determine the best approach to choosing which circuits are addressed first.

6. Implement a Program to Place All New Customer Services Underground

This idea involves working with various municipalities to develop local ordinances that would require all new and upgraded services to be located underground. For example, in St. Louis County about half of the municipalities require underground service for new and upgraded services. This idea would extend that to all AmerenUE service areas.

7. Implement a Program to Place All Existing Customer Services Underground

Systematically start to replace existing customer services underground. This is essentially an extension of #6 above, although the implications are more extensive. In this case, customers would likely have make-ready work on their electric service entrance. The program could be approached from two directions: providing customers an option of converting to underground or making the conversion mandatory. Analysis would be required to determine the best approach to prioritizing the locations and number of services to be addressed each year. Coordination with local municipalities and customer groups would be essential for this program to be a success.

Note: Approaches 4 – 7 above are from Attachment A to the letter dated January 4, 2007. The entire letter can be accessed at: http://www.ameren.com/Outage/ADC_AmerenUEResponse.pdf

APPENDIX E

(Subsection 2(a) of the *Pipeline Inspection, Protection, Enforcement, and Safety Act of 2006*)

H.R.5782

Pipeline Inspection, Protection, Enforcement, and Safety Act of 2006 (Enrolled as Agreed to or Passed by Both House and Senate)

SEC. 2. PIPELINE SAFETY AND DAMAGE PREVENTION.

(a) One Call Civil Enforcement-

(1) PROHIBITIONS- Section 60114 is amended by adding at the end the following:

`(d) Prohibition Applicable to Excavators- A person who engages in demolition, excavation, tunneling, or construction--

`(1) may not engage in a demolition, excavation, tunneling, or construction activity in a State that has adopted a one-call notification system without first using that system to establish the location of underground facilities in the demolition, excavation, tunneling, or construction area;

`(2) may not engage in such demolition, excavation, tunneling, or construction activity in disregard of location information or markings established by a pipeline facility operator pursuant to subsection (b); and

`(3) and who causes damage to a pipeline facility that may endanger life or cause serious bodily harm or damage to property--

`(A) may not fail to promptly report the damage to the owner or operator of the facility; and

`(B) if the damage results in the escape of any flammable, toxic, or corrosive gas or liquid, may not fail to promptly report to other appropriate authorities by calling the 911 emergency telephone number.

`(e) Prohibition Applicable to Underground Pipeline Facility Owners and Operators- Any owner or operator of a pipeline facility who fails to respond to a location request in order to prevent damage to the pipeline facility or who fails to take reasonable steps, in response to such a request, to ensure accurate marking of the location of the pipeline facility in order to prevent damage to the pipeline facility shall be subject to a civil action under section 60120 or assessment of a civil penalty under section 60122.

`(f) Limitation- The Secretary may not conduct an enforcement proceeding under subsection (d) for a violation within the boundaries of a State that has the authority to impose penalties described in section 60134(b)(7) against persons who violate that State's damage prevention laws, unless the Secretary has determined that the State's enforcement is inadequate to protect safety, consistent with this chapter, and until the Secretary issues, through a rulemaking proceeding, the procedures for determining inadequate State enforcement of penalties.'.

(2) CIVIL PENALTY- Section 60122(a)(1) is amended by striking `60114(b)' and inserting `60114(b), 60114(d),'.