BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of an Investigation into the Natural Gas Incident in Boonville, Missouri, on the System Operated by AmerenUE	))))	Case No. GS-2006-0199

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 November 4, 2005, Staff filed a *Motion To Establish Case* initiating the above-captioned case.

2. On November 10, 2005, the Commission issued its *Order Establishing Case* (Order) for the purpose of receiving the *Gas Incident Report* (Report) resulting from Staff's formal investigation of the incident that occurred in Boonville on October 10, 2005. On November 14, 2005, the Commission issued its *Order Extending Time To File Report* directing the Staff to file its Report by March 10, 2006, with the order further stating "That AmerenUE *may* file a response to Staff's Report no later than 30 days after Staff's report is filed."

3. Staff has investigated the incident that occurred in Boonville and submits its Report attached hereto as Exhibit A, with supporting Appendices A through D, and incorporated by reference herein.

4. In accordance with the results of Staff's investigation and its recommendation based on the facts contained in its Report (Exhibit A), Staff counsel is concurrently filing a separate Complaint case against AmerenUE regarding a violation of Commission Rule 4 CSR 240-40.030(12)(O)1.A and B.

5. Because Staff's Report contains recommendations developed from its investigation, Staff requests the Commission issue an order requiring AmerenUE to file a response addressing each of Staff's recommendations within 30 days of the filing of this Report.

WHEREFORE, consistent with previous Commission orders, the Staff submits its Report in this case as directed, and asks the Commission to issue an order directing AmerenUE to file a response addressing Staff's recommendations within 30 days of the filing of this Report.

Respectfully submitted,

/s/ Robert S. Berlin

Robert S. Berlin
Associate General Counsel
Missouri Bar No. 51709

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

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 this 10th day of March 2006.

/s/ Robert S. Berlin

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of an Investigation into the Natural Gas Incident in Boonville, Missouri, on the System Operated by AmerenUE	)))	Case No. GS-2006-0199

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 March 10, 2006, consisting of thirteen pages and Appendices A through D; that information in the Gas Incident Report was given by 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

Subscribed and sworn to before me this 10th day of MARCH, 2006.

NOTARY PUBLIC

SHARON S WILES
Notary Public - Notary Seal
STATE OF MISSOURI
COLE COUNTY
MY COMMISSION EXP. SEPT 11,2006

Missouri Public Service Commission

Gas Incident Report

AmerenUE
Case No. GS-2006-0199

Boonville, Missouri
October 10, 2005

Gas Safety/Engineering Section … Energy Department ... Utility Operations Division
March 2006… Jefferson City, Missouri

Exhibit A

Table of Contents

SYNOPSIS

At approximately 11:35 a.m., Central Daylight Time (all times in this report are Central Daylight Time) on Monday, October 10, 2005, a natural gas valve was opened to a section of the Boonville natural gas systems that was being converted from low-pressure to high-pressure. Natural gas at a pressure of 10 pounds per square inch gauge (psig) entered the system section being converted as intended, but also entered the Boonville low-pressure system through a connecting main that had not been disconnected. The pressure in the Boonville low-pressure system began rising from approximately 10 inches of water column towards 10 psig. At 11:52 a.m., the first of several 911 calls were received regarding house fires and other problems related to the high gas pressure. Seven residences and the fire station received varying levels of fire and smoke damage, and a number of other customers received over-pressure damage to natural gas utilization equipment. The total property damage was estimated by AmerenUE to be $600,000.

AmerenUE operates the natural gas distribution systems in Boonville, Missouri. The low-pressure system has a maximum allowable operating pressure (MAOP) of 14 inches of water column (approximately ½ psig). The entire low-pressure system and the 10 psig system were shut down. The customers in these systems plus other customers who shut off their own service resulted in a total outage of about 1,200 Boonville customers.

The Missouri Public Service Commission's Energy Department - Gas Safety/Engineering Staff (Staff) has determined that the probable cause of the incident was the over-pressurization of the Boonville low-pressure system due to an operator error during a system conversion from low-pressure to high-pressure. AmerenUE did not have adequate procedures in place to ensure that all main connections from the system being converted were separated from the low-pressure system or to monitor the pressures in both systems during the conversion.

The Staff has determined that evidence exists to conclude that AmerenUE violated a Missouri Public Service Commission (Commission) regulation regarding operating a natural gas system in excess of both the MAOP and the safe operating pressure for some of the connected natural gas utilization equipment. The system over-pressurization contributed to this incident by causing this natural gas utilization equipment to be over-pressured, resulting in some natural gas ignitions and fires. The Staff is making five recommendations as a result of this investigation, including a recommendation that the Office of General Counsel file a complaint with the Commission regarding the violation.

CONCLUSIONS

1. At approximately 11:35 a.m. on Monday, October 10, 2005, a natural gas valve was opened to allow natural gas at a pressure of 10 psig to enter the main and service lines in the 1200 block of 6th Street. A low-pressure natural gas main on Roberts Street was still connected to the main on 6th Street, resulting in the unintended flow of natural gas from the 10 psig high-pressure system into the Boonville low-pressure system.

2. The Boonville low-pressure system was over-pressured above its MAOP[1] of 14 inches of water column and increased in pressure towards 10 psig. This over-pressure caused low-pressure gas utilization equipment at numerous locations to begin operating in an unsafe manner, including instances of higher than normal flames and natural gas leaking from equipment components. Most of these equipment components were damaged by the over-pressurization and required repair or replacement.

3. Natural gas ignitions occurred at 603 4th Street, 1312 4th Street, 1313 4th Street, 500 Bingham Street, 519 High Street, 813 Morgan Street, 1303 Nelson Street, and 1400 Nelson Street. The most extensive fire and smoke damage occurred at 1312 4th Street. Varying levels of fire and smoke damage occurred at the other addresses. There were no injuries reported.

4. The probable cause of the incident was the over-pressurization of the Boonville low-pressure system resulting in multiple ignitions of natural gas that had escaped from connected gas utilization equipment.

5. The over-pressurization was caused by the failure of AmerenUE to direct its contractor to separate the low-pressure natural gas main on Roberts Street from the natural gas main on 6th Street before introducing 10 psig natural gas into this main on 6th Street.

6. Contributing to this over-pressurization was the failure of AmerenUE to have and use adequate procedures to guide the conversion of the 1200 block of 6th Street from low-pressure to high-pressure. The Staff concludes that AmerenUE did not have a written plan and checklist for this conversion that identified the low-pressure main on Roberts Street and required it to be separated before proceeding with the conversion. The Staff concludes

[1] 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.

further that AmerenUE did not have pressure gauges installed on the piping in the area of the conversion and was not monitoring the pressure in the low-pressure system during the conversion. Another method to verify no connection to the low-pressure system would have been to blow down the isolated section and ensure it dropped to 0 inches of water column.

7. The Staff's investigation did not reveal any probable violations by AmerenUE related to the emergency response.

8. AmerenUE plans to replace all but two of their remaining low-pressure distribution systems in Missouri with high-pressure systems during 2006. This work will probably involve conversions of sections of the systems from low-pressure to high-pressure, which is the type of work that was involved in this incident.

9. AmerenUE provided a monitor regulator[2] for over-pressure protection at each of the three pressure regulator stations that supplied natural gas to the Boonville low-pressure distribution system. Because monitor regulators are not designed to provide over-pressure protection for high-pressure gas entering the low-pressure system at a location downstream of the regulator station, the monitor regulators did not prevent or lessen the over-pressurization that occurred in this incident.

10. The Staff has determined that evidence exists to conclude that AmerenUE violated 4 CSR 240-40.030(12)(O)1.A. and B., which states: "No person may operate a low-pressure distribution system at a pressure greater than –
    A. A pressure high enough to make unsafe the operation of any connected and properly adjusted low-pressure gas utilization equipment; or
    B. An equivalent of fourteen inches (14") water column."

11. The Staff has requested the Office of General Counsel to file a complaint against AmerenUE regarding the probable violation of 4 CSR 240-40.030(12)(O)1.A. and B.

[2] A second regulator at a regulator station that "monitors" the downstream pressure. If an operating regulator failure causes the pressure in the downstream system to rise, the monitor regulator begins to regulate the downstream pressure and protect the downstream system from over-pressurization.

RECOMMENDATIONS

1. Based on a review of factors related to this incident, AmerenUE initiated actions to develop a new procedure for converting a distribution system section from low-pressure to high-pressure. The Staff was considering a recommendation in this Incident Report that would request AmerenUE to develop a new procedure for system conversion similar to the draft procedure that AmerenUE has developed and provided to the Staff.

   The Staff recommends that AmerenUE finalize this new procedure for converting distribution systems and then submit the new procedure to Staff for review before converting any more low-pressure systems in Missouri.

2. The Staff recommends that AmerenUE:
   A. Submit to Staff a schedule for each low-pressure system in Missouri that AmerenUE plans to replace with a high-pressure system.
   B. Submit to Staff a work plan prior to each low-pressure system replacement and information related to any system conversions that are part of the plan.
   C. Notify the Staff prior to each system conversion so that Staff has an opportunity to observe the work.

3. The Staff recommends that AmerenUE evaluate, and enact as appropriate, additional safety measures for each low-pressure system that will continue to operate as a low-pressure system. At a minimum, the Staff recommends that AmerenUE install high-capacity pressure relieve valves in each of these low-pressure systems. The Staff recommends that AmerenUE submit to Staff a report for each evaluation and a schedule for any actions that are proposed.

4. The Staff recommends that AmerenUE file a response to each Recommendation within 30 days of the filing of this Incident Report. The Staff recommends that this Case remain open until AmerenUE's filing has been received and reviewed by the Commission.

5. The Staff recommends that the Office of General Counsel cause a complaint to be filed with the Commission regarding the violation noted in the CONCLUSIONS section of this Incident Report.

FACTS

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

The Incident

At approximately 11:35 a.m., on Monday, October 10, 2005, a natural gas valve was opened that resulted in the unintended flow of natural gas from a 10 psig high-pressure system into the Boonville low-pressure system. At approximately 11:52 a.m., a natural gas ignition and subsequent fire occurred at 519 High Street. At approximately 11:54 a.m., a natural gas ignition occurred at the furnace in 1303 Nelson Street. At approximately 11:57 a.m., a natural gas ignition occurred at 813 Morgan Street. At approximately 11:59 a.m., a natural gas ignition and subsequent fire occurred at 1312 4th Street. At approximately 11:59 a.m., a natural gas ignition and subsequent fire occurred at 1400 Nelson Street. At approximately 11:59 a.m., a natural gas ignition occurred at the furnace in 500 Bingham Street (fire station for the Boonville Fire Department). In addition, natural gas ignitions occurred at furnaces in 1313 4th Street and 603 4th Street (Apartment A).

Personal Injuries

No injuries were reported.

Property Damage

The two-story residential structure located at 1312 4th Street received extensive fire and smoke damage in the basement and both upper floors (see Appendix A-1, Photograph 1 and 2). The property damage was estimated by the Boonville Fire Department to be $125,000.

The two-story residential structure located at 519 High Street received extensive fire and smoke damage in the basement and first floor (see Appendix A-1, Photograph 3). The property damage was estimated by the Boonville Fire Department to be $100,000.

The single-story residential structure located at 1400 Nelson Street received fire and smoke damage in the utility room (see Appendix A-1, Photograph 4). The property damage was estimated by the Boonville Fire Department to be $30,000.

The single-story residential structure located at 1303 Nelson Street received fire and smoke damage in the basement at the furnace (see Appendix A-1, Photograph 5). The property damage was estimated by the Boonville Fire Department to be $7,500.

The single-story residential structure located at 1313 4th Street received fire and smoke damage in the basement at and above the furnace. The property damage was estimated by the Boonville Fire Department to be $7,500.

The fire station at 500 Bingham Street received fire and smoke damage at the furnace. The property damage was estimated by the Boonville Fire Department to be $1,000.

The residence at 813 Morgan Street received fire and smoke damage at the furnace. The Boonville Police Department responded to this location, so the property damage was not estimated by the Boonville Fire Department.

Apartment A at 603 4th Street received fire and smoke damage at the furnace. AmerenUE personnel indicated the damage was similar to 1303 Nelson Street. The property damage at 603 4th Street was not estimated by the Boonville Fire Department.

A number of other residences served by the Boonville low-pressure system received over-pressurization damage to a component of the furnace and/or other natural gas utilization equipment. An example of this was the gas control valve in the furnace at 311 High Street (see Appendix A-1, Photograph 6).

The addresses in this Property Damage section are shown on the Boonville map in Appendix B. The total property damage/loss was estimated at $600,000 in a report submitted by AmerenUE (see Appendix C, Part A, Item 5c in the report).

Natural Gas System

AmerenUE operates the natural gas distribution systems in Boonville, Missouri. The low-pressure system in Boonville is located in the downtown business district and the surrounding residential areas, predominantly to the south of the downtown area. The low-pressure system normally operates at approximately 10 inches of water column and the maximum allowable operating pressure (MAOP) is 14 inches of water column (14" w.c.) as required by 4 CSR 240-40.030(12)(O)1.B.[3] The low-pressure system is supplied by three regulator stations named Spring Street, Spruce Street, and Walnut Street. Each regulator

[3] MoPSC regulation 4 CSR 240-40.030(12)(O)1.A. also requires that a low-pressure system may not be operated above a pressure high enough to make unsafe the operation of any connected and properly adjusted low-pressure gas utilization equipment. This regulation corresponds to 49 CFR §192.623(a).

station has a pressure chart that records the outlet pressure in the low-pressure system. Over-pressure protection for each regulator station is provided by a monitor regulator. There are no pressure relief valves located on the low-pressure system.

The pressure chart for the Spring Street regulator station indicated the outlet pressure was 10.2" w.c. prior to the pressure surge and off the chart (the top increment on the chart is 15" w.c.) during the pressure surge. The pressure chart for the Spruce Street regulator station indicated the outlet pressure was 9.5" w.c. prior to the pressure surge and above 15" (above the top increment of 15" w.c.) during the pressure surge. The pressure chart for the Walnut Street regulator station indicated the outlet pressure was 9.4" w.c. prior to the pressure surge and rose to 14" w.c. during the pressure surge, at which point it stopped recording until after the pressure surge.

Missouri Public Service Commission 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 a Staff member at 1:50 p.m. on October 10, 2005.

2. AmerenUE notified the United States Department of Transportation-Office of Pipeline Safety (DOT-OPS) of a natural gas incident on October 10, 2005. (NRC Report Number 775613).

3. DOT-OPS form PHMSA F 7100.1 titled "Incident Report – Gas Distribution System" was completed by AmerenUE and submitted to Staff on November 8, 2005. A copy is attached in Appendix C. The Staff forwarded the report to DOT-OPS on November 14, 2005. (In Part A, Item 7 labeled "Telephone Report", the date of October 11, 2005 is a typographical error and should be October 10, 2005.)

Company Actions

AmerenUE conducts monthly odorant concentration tests[4] in Boonville and uses customers to participate in the tests. Tests were conducted in Boonville at two customer locations on

[4] MoPSC regulation 4 CSR 240-40.030(12)(P)6., requires at least monthly odor intensity tests of the natural gas to assure the proper odorant concentration has been achieved.

September 28, 2005. Records indicated the natural gas to be adequately odorized at a concentration of 0.05 percent (%) gas-in-air[5].

AmerenUE provided information regarding actions by AmerenUE personnel and contractor personnel related to the incident in the narrative description portion of Form PHMSA F 7100.1. See Appendix C for "Part G – Narrative Description of Factors Contributing to the Event".

The resulting outage involved the entire Boonville low-pressure system, the high-pressure system served by the South Street regulator station, and customers outside of these two systems who shut their own service off. AmerenUE issued a press release on Wednesday, October 12 noting that about 700 customers were served by the low-pressure system that was shut off when gas at intermediate pressure flowed into the low-pressure system (see press release in Appendix D). The press release further noted that additional customers shut off their own gas as a precaution when the incident occurred, for an outage of about 1,000 customers. The high-pressure system served by the South Street regulator station and operating at 10 psig was shut down early in the incident and affected approximately 196 customers. This system had been converted to 10 psig prior to the incident. The addition of the outages in this system resulted in a total outage of about 1,200 Boonville customers. AmerenUE issued another press release on Wednesday, October 12 reporting it had restored natural gas service to all but about 125 customers who lost gas service on Monday (October 10). At 11 a.m. on October 13, AmerenUE personnel reported to Staff that natural gas had been restored to all but 4 customers who could not be located.

MoPSC regulation 4 CSR 240-40.030(12)(L) requires natural gas system operators to establish procedures for investigating accidents and failures for the purpose of determining the causes of failure and minimizing the possibility of a recurrence. The DOT-OPS form PHMSA F 7100.1 submitted by AmerenUE listed the cause of the incident as operator error that involved inadequate procedures. The narrative description notes:

> It was noted that the low pressure system was pressurized to 10 psig so the Superintendent instructed the Supervisor to shut down and isolate the entire low pressure system. … AmerenUE investigated and discussed the situation to determine the cause of the over pressurization. It was identified that a 4" main connecting the low pressure system and the system to be converted to

[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 of 4.5% gas-in-air.

10 psig was overlooked and was not separated prior to introducing the 10 psig. This allowed the 10 psig to flow into the low pressure system, which is supplied by regulator stations that are in a monitor configuration, causing the system over pressurization.

As a result of this incident, AmerenUE is in the process of implementing a new policy which will require a written procedure to be followed when performing this type of work (converting sections of a low-pressure system to a high-pressure system). A draft of this policy has been provided to the Staff.

AmerenUE has been replacing low-pressure systems and converting them to high-pressure systems over the last 25 years. The cast iron, ductile iron, and bare steel pipe in these low-pressure systems was replaced. AmerenUE has made it a priority to replace these types of systems and will complete this work in 2006. After completion of this work, AmerenUE will only operate two low-pressure systems going forward. Both systems are located in downtown Jefferson City, Missouri.

Missouri Public Service Commission Staff Investigation

Two members of the Staff traveled to the AmerenUE office in Boonville on the afternoon of October 10, 2005. Staff met with AmerenUE personnel regarding actions prior to Staff's arrival and the ongoing actions regarding the natural gas outage. The low-pressure system had been shut down and AmerenUE personnel were shutting off gas meters affected by this outage. It was agreed that a leak survey should be conducted of the low-pressure system piping that was over-pressured when natural gas was reintroduced.

Staff and AmerenUE personnel then traveled to observe residences where damage had been reported. At 1303 Nelson Street, fire damage was observed at the furnace (See Appendix A, Photograph 5). It was indicated by the resident that her husband was home when it occurred. He heard a "loud pop", observed flames, called the Fire Department, and put the fire out before the Fire Department arrived. It was noted that the control knob on the furnace control box was melted. The resident mentioned that 1400 Nelson was also damaged by fire. At 1400 Nelson, a fire at the hot water home heating system (for the main floor) had damaged the unit and surrounding utility room (See Appendix A, Photograph 4). The adjacent water heater did not appear to be damaged. The hot water home heating system (for the basement) in the basement garage did not appear to be damaged.

Entry could not be gained to 1313 4th Street. At 1312 4th Street, extensive fire damage was observed in the basement, especially above the furnace and at the nearby stairway to the main floor (See Appendix A, Photographs 1 and 2). The furnace was damaged due to the over-pressurization, but the nearby water heater did not appear to have been damaged due to over-pressurization. The severe fire damage followed the stairwell and ductwork all the way to the second floor.

At 519 High Street, some fire damage was observed on the main floor where fire came up through the floor heating ducts. The owner said he heard a "boom", went to the basement, and saw flames coming out of the top of the furnace. There were two forced-air furnaces and a water heater in the basement. One of the two furnace units was damaged with the control valve knobs melted and fire damage above the unit at the ceiling (See Appendix A, Photograph 3). The other furnace unit and water heater did not appear to be damaged.

At 7:30 p.m. on October 10, 2005, AmerenUE personnel indicated that most of the gas meters affected by the outage had been shut off.

Upon returning to Boonville on October 11, Staff observed the area where the work had been performed the day before to convert a section of the low-pressure system to high-pressure. This involved the 1200 block of 6th Street between Bingham and South Streets. The Staff observed the homes in this block and noted that each had a low-pressure meter set with a service regulator lying nearby on the ground (See Appendix A, Photograph 7). The service regulators had been installed on October 10 in preparation for conversion to a high-pressure system, but had been removed after the incident so that the customers in this block could have their low pressure gas service restored. The excavations in the area were observed and involved points where system piping was separated or had been squeezed-off. The excavation at the southeast corner of 6th Street and Roberts Street included the 4-inch polyethylene main, which had not been separated prior to the incident and allowed the 10 psig gas to flow to the east on Roberts Street and into the low-pressure system. At the time of observation on October 11, this 4-inch main had been cut and capped in each direction (See Appendix A, Photograph 8). AmerenUE personnel indicated that this separation was made during the afternoon of October 10, after the incident.

The Staff went to two other locations on October 11 where over-pressure damage was reported. At 311 High, an HVAC contractor was on-site and replacing the furnace control valve that had been over-pressured. (See Appendix A, Photograph 6) The resident said he heard a "roaring noise" down in the basement and the furnace pilot light was a "torch". He tried to turn off the

furnace control valve, but gas started blowing out around the knob, so he turned off a separate fuel line valve at the basement ceiling near the furnace. No damage was observed to the water heater. At 104 N. 6th Street, the resident said he was out front when 519 High caught fire (a few homes to the west). He went to his basement and noted a gas odor at the furnace and the furnace pilot light had been blown out (was on the night before). He turned off the furnace at the control valve and then shut off the valve at the outside gas meter. No damage was observed to the water heater. AmerenUE tried to light the furnace at about 2 a.m. the previous morning, but flames shot up about 10" high when the furnace came on and it had to be left off. He was trying to get a HVAC contractor to repair his furnace.

The Staff also went to 303, 324, and 328 Main Street on October 11 to sample a few locations from where 911 calls had been received at the time of the incident. Persons at these commercial businesses each conveyed stories related to gas odors and a "hissing noise" at the furnace or overhead heater.

Copies of pressure charts from the three regulator stations that regulated the flow of gas into the low-pressure system were provided to Staff and discussed. The Staff inquired about the circumstances related to the pressure chart pen for the Walnut Street regulator station rising to 14" w.c. during the pressure surge, at which point it stopped recording until after the pressure surge. AmerenUE later responded to Staff that the pressure chart pen was found in the early afternoon to have gone off the pressure chart and become hung up – the pen was then put back on the pressure chart.

ANALYSIS

Over-Pressure of the Low-Pressure System

Natural gas from a high-pressure system operating at 10 psig flowed north through the natural gas main on 6th Street, east through the natural gas main on Roberts Street that was not separated, and into the Boonville low-pressure system. This caused the pressure in the low-pressure system to surge upwards from 10" w.c., as recorded on the pressure charts at the three regulator stations. During the pressure surge, the pressure in the low-pressure system would have been highest at the natural gas entry point on Roberts Street. There were no pressure relief devices connected to the low-pressure system and the venting flow rate from over-pressured utilization equipment would not have been enough to stop the pressure buildup towards 10 psig, with the 10 psig natural gas flowing directly into the low-pressure system. The only method available to stop the pressure buildup was to shut off the source of the 10 psig natural gas and vent it by opening pipes in the low-pressure system. AmerenUE took these actions after becoming aware of the over-pressure condition. The Staff did not determine the maximum pressures that occurred in the low-pressure system during the pressure surge. However, the pressure charts at the regulator stations recorded that the pressure exceeded 15" w.c., and the damage to components of the connected utilization equipment is evidence the pressure exceeded the maximum safe operating pressure for the equipment that was damaged.

Low-Pressure System Design

The pressure in a low-pressure distribution system is at a safe pressure for use by low-pressure utilization equipment, typically between 7" w.c. and 10" w.c. Therefore, no service regulator is needed at the meter set (service regulators are required at meter sets connected to high-pressure distribution systems and typically reduce the pressure to 7" w.c.). Low-pressure distribution systems are normally supplied by high-pressure distribution systems through regulator stations. The Commission's pipeline safety regulations in Rule 4 CSR 240-40.030 require adequate over-pressure protection to be provided for the low-pressure system at regulator stations in the event of a regulator failure. The methods employed for over-pressure protection are not specified in the regulations.

AmerenUE complied with the regulations by providing a monitor regulator at each of the three pressure regulator stations regulating the flow of gas into the Boonville low-pressure

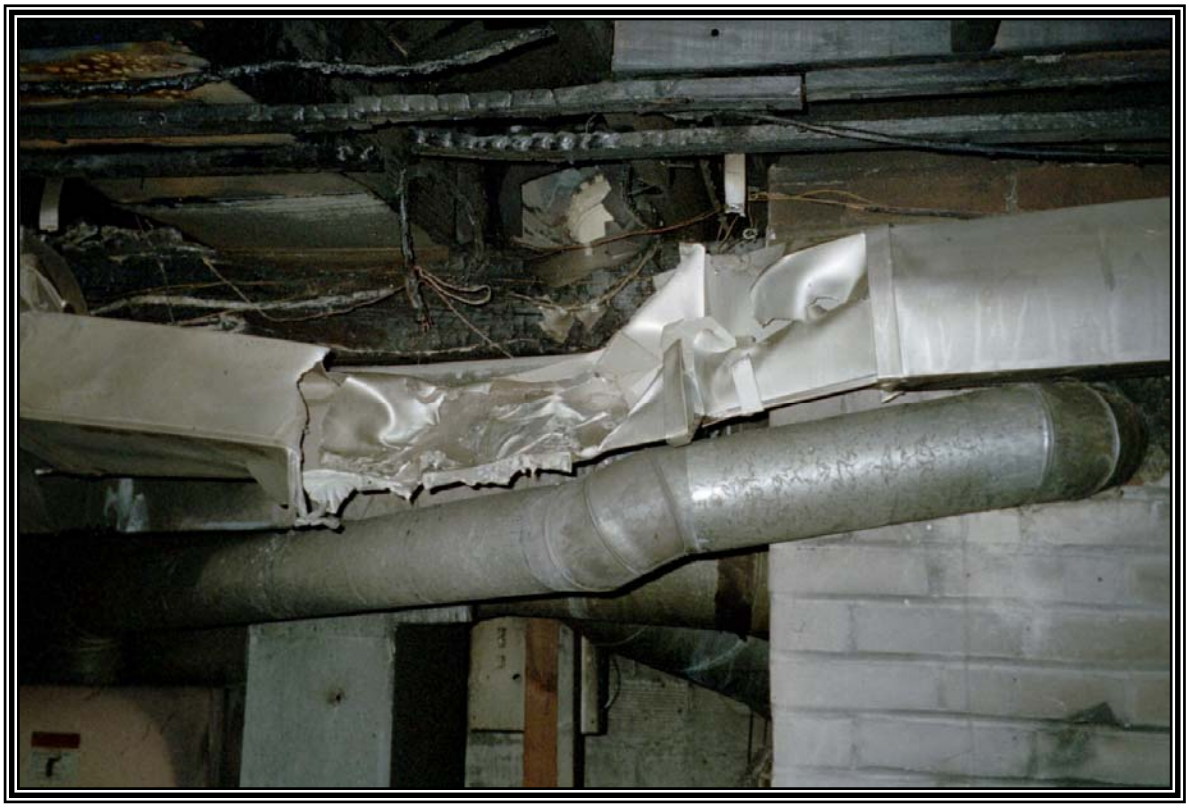
distribution system. Monitor regulators are not designed to provide over-pressure protection for high-pressure gas entering the low-pressure system at a location downstream of the regulator station, as occurred in this incident. The monitor regulators therefore could not prevent the over-pressurization that occurred in this incident. While not required, the use of a pressure relief device instead of (or in addition to) a monitor regulator for over-pressure protection of each regulator station would provide an added level of system over-pressure protection in a situation like this incident. If a pressure relief device had been installed at each regulator station for the Boonville low-pressure system, then three pressure relief devices would have activated and been relieving gas from the low-pressure system to the atmosphere. This would have reduced the pressure increase in the low-pressure system by an undetermined amount, and provided a visual and audible warning to persons in the area. The Staff believes this would have been beneficial, but has not determined if this would have prevented the incident or reduced its magnitude.

Converting a Low-Pressure System Section to High-Pressure

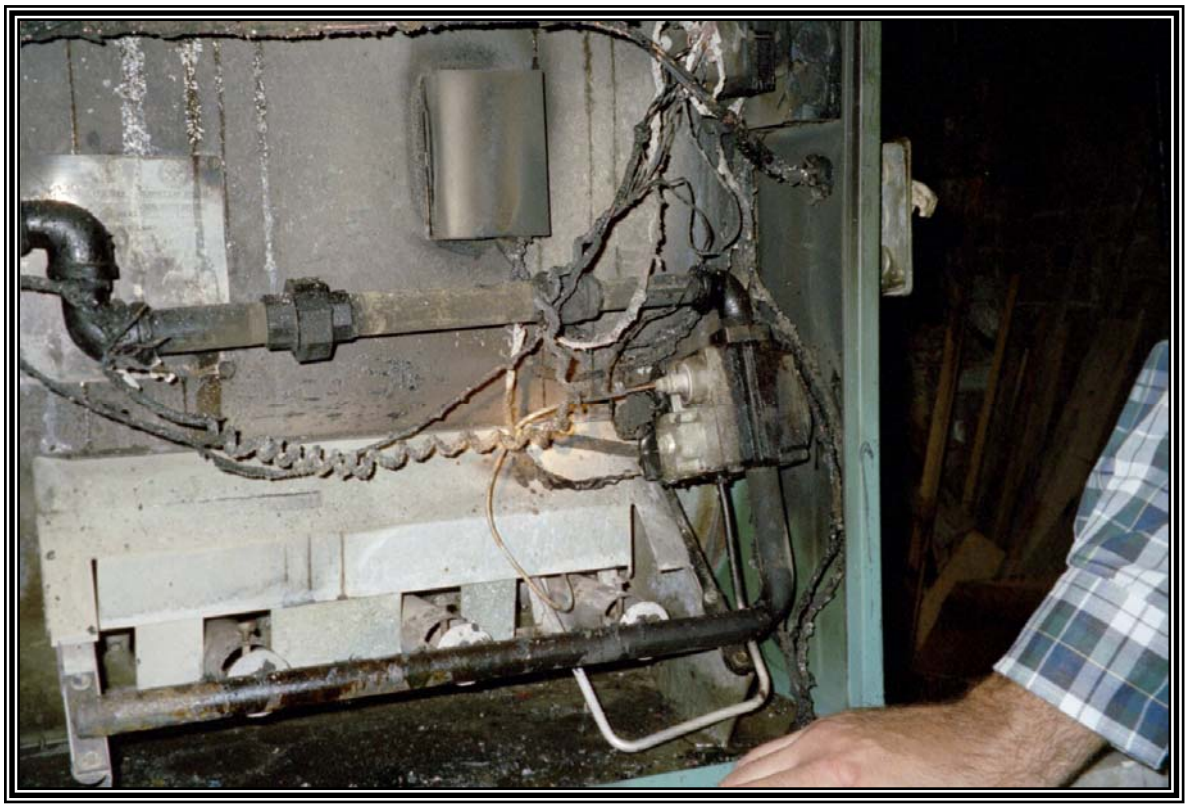
During the replacement of a low-pressure distribution system with a high-pressure distribution system, some sections of the low-pressure system are often already replaced with piping that is qualified and pressure tested to operate at high-pressure. These sections can be converted to high-pressure by installing service regulators at each meter set and raising the pressure. To avoid over-pressurization, it is critical that each meter set have a service regulator installed and that all connections to the low-pressure system be separated from the system section. A written procedure and checklist is needed to verify that each service regulator is installed and each connection to the low-pressure system is separated. Pressure gauges installed on the involved piping and the adjacent low-pressure system would assist in verifying that the pressure only increases in the system section being converted. An alternative method would be to open the system section to be converted and allow the pressure to blow down to and remain at 0" w.c. for a period of time, to ensure that it is not being back fed from a connection to the low-pressure system.

APPENDIX A

(Photographs)



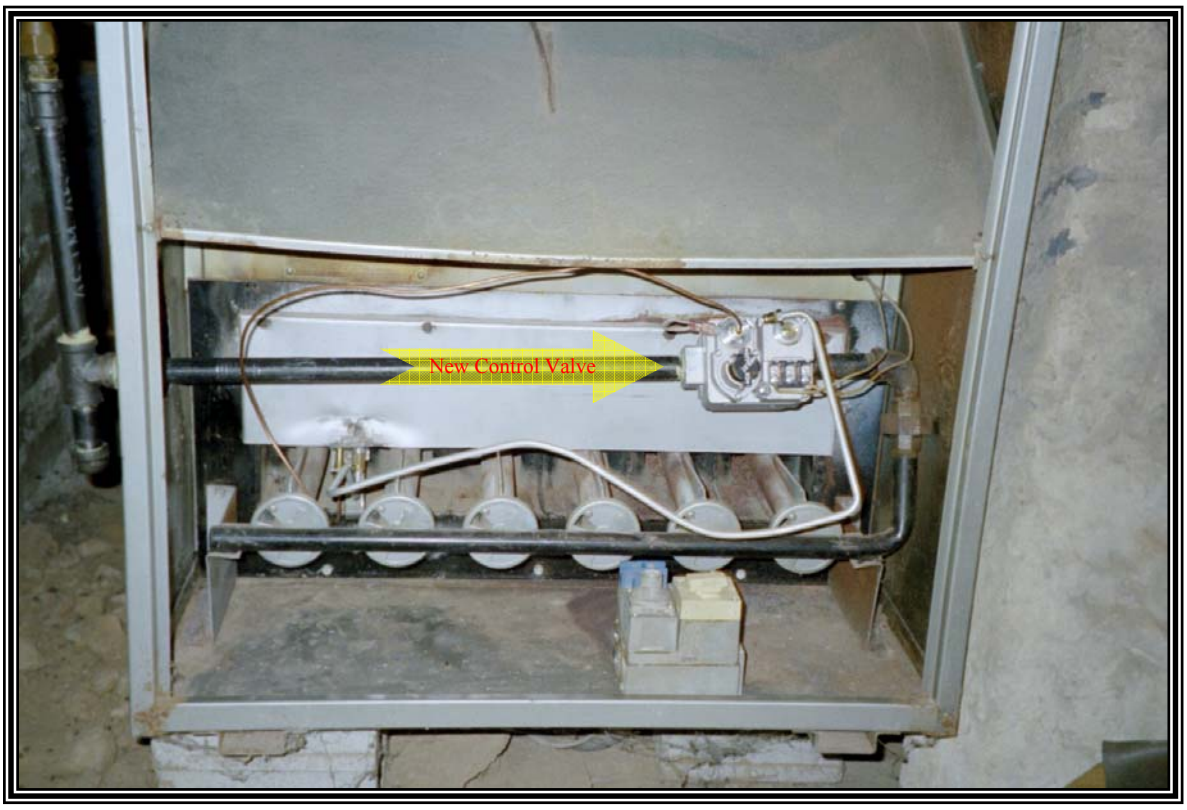
Photographs 1 & 2 Top view shows the duct and vent system for 1312 4th Street that was located directly above the natural gas furnace (shown in the bottom view). The furnace was located in the basement area.



Photograph 3 View of the damaged natural gas furnace in the basement of 519 High Street.

Photograph 4 View of the hot water home heating system for 1400 Nelson Street which is located on the main level.

Photograph 5 Looking at the natural gas furnace for 1303 Nelson Street.



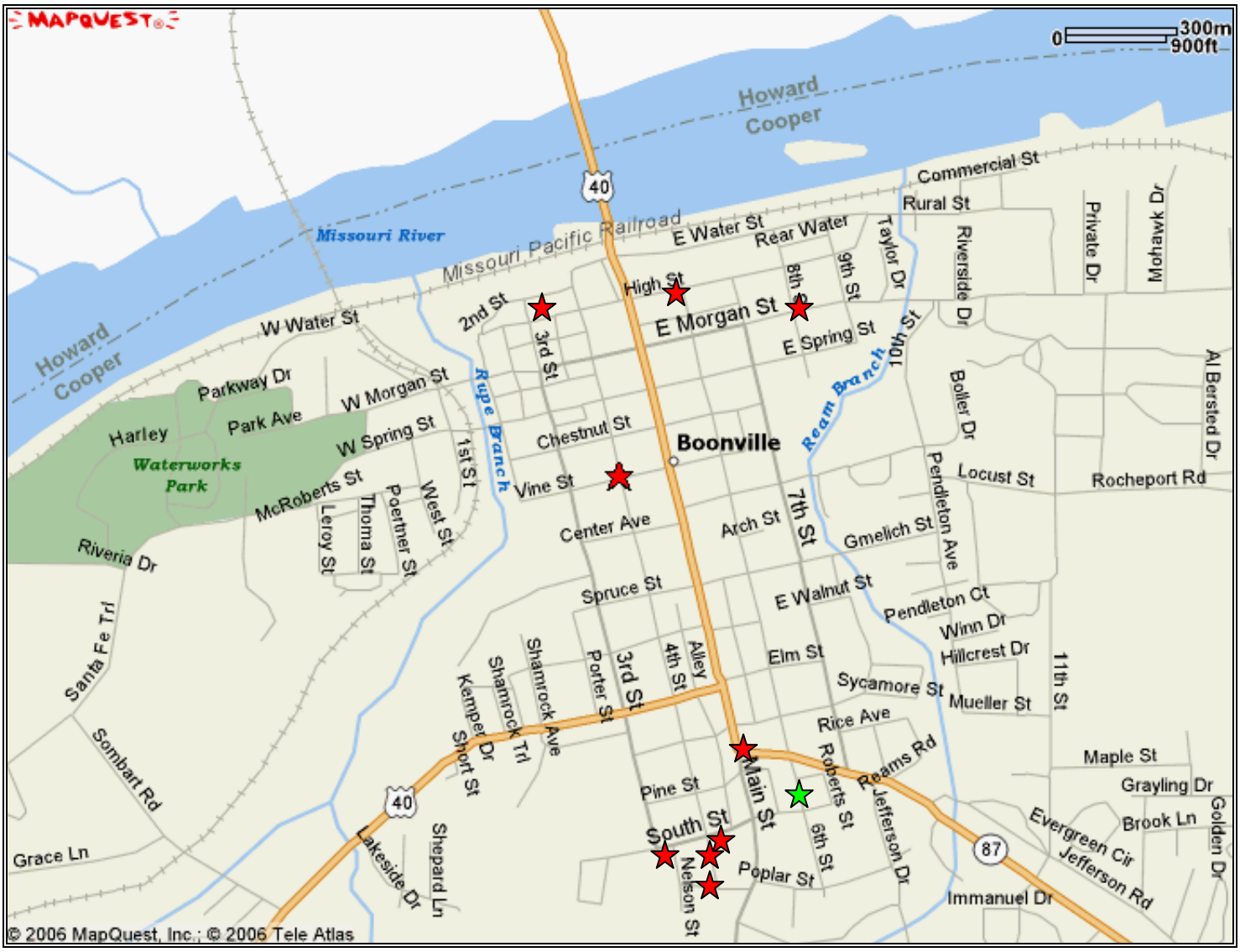
Photograph 6 View of the natural gas furnace for 311 High Street. The HVAC contractor was onsite replacing the furnace control valve. The picture shows the new control valve installed and the old one is lying beneath.

Photograph 7 Looking south at the natural gas meter that is located on the north side of 1222 6th Street. Observe that no pressure regulator is installed due to the fact that the meter is connected to the low-pressure system. Notice the new service regulator that is lying on the ground.

Photograph 8 View looking west at an excavation that was located at the southwest corner of 6th Street and Roberts Street.

APPENDIX B

(Boonville Map for Incident Area)



(The above map was provided by MapQuest)

N

LEGEND DESCRIPTION

- Denotes the locations included in the Property Damage Section of the Incident Report
- Denotes the 1200 block of 6th Street

Figure 1
Map of Boonville, Missouri

Appendix B-1

APPENDIX C

(DOT-OPS form PHMSA F 7100.1)

NOTICE: This report is required by 49 CFR Part 191. Failure to report can result in a civil penalty not to exceed $100,000 for each violation for each day the violation continues up to a maximum of $1,000,000 for any related series of violations as provided in 49 USC 60122.

Form Approved
OMB No. 2137-0522

U.S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration

INCIDENT REPORT - GAS DISTRIBUTION SYSTEM

Report Date _____
No. _____
(DOT Use Only)

INSTRUCTIONS

Important: *Please read the separate instructions for completing this form before you begin. They clarify the information requested and provide specific examples. If you do not have a copy of the instructions, you can obtain one from the Office Of Pipeline Safety Web Page at* http://ops.dot.gov.

PART A – GENERAL REPORT INFORMATION Check: ☒ Original Report ☐ Supplemental Report ☐ Final Report

1. Operator Name and Address

a. Operator's 5-digit Identification Number / 2 / 0 / 0 / 5 / 0 /

b. If Operator does not own the pipeline, enter Owner's 5-digit Identification Number / / / / / /

c. Name of Operator Union Electric Company D/B/A as AmerenUE

d. Operator street address 1901 Chouteau Avenue

e. Operator address St. Louis, MO St. Louis County, 63103
City, County or Parish, State and Zip Code

2. Time and date of the incident

/ 1 / 1 / 5 / 3 / hr. / 1 / 0 / month / 1 / 0 / day / 0 5 / year

3. Incident Location

a. 6th Street, South Street and Roberts Street
Street or nearest street or road

b. Boonville Cooper County
City and County or Parish

c. Missouri 65233
State and Zip Code

d. Latitude: / 9 / 6 / 3 / 6 / 6 / Longitude: / 7 / 4 / 1 / 7 / 6 /
(if not available, see instructions for how to provide specific location)

e. Class location description
○ Class 1 ○ Class 2 ● Class 3 ○ Class 4

f. Incident on Federal Land ○ Yes ● No

4. Type of leak or rupture

○ Leak: ○ Pinhole ○ Connection Failure *(complete sec. F5)*

○ Puncture, diameter or cross section *(inches)* ____

○ Rupture (if applicable):

○ Circumferential – Separation

○ Longitudinal

- Tear/Crack, length *(inches)* _____

- Propagation Length, total, both sides *(feet)* _____

● N/A

○ Other: _____

5. Consequences *(check and complete all that apply)*

a. ☐ Fatality Total number of people: / / / /

Employees: / / / / *General Public:* / / / /

Non-employee Contractors: / / / /

b. ☐ Injury requiring inpatient hospitalization

Total number of people: / / / /

Employees: / / / / *General Public:* / / / /

Non-employee Contractors: / / / /

c. ☒ Property damage/loss *(estimated)* Total $ 600,000

Gas loss $_____ Operator damage $_____

Public/private property damage $ 600,000

d. ☒ Gas ignited ○ Explosion ● No Explosion

e. ☐ Gas did not ignite ○ Explosion ○ No Explosion

f. ☐ Evacuation *(general public only)* / / / / / people

Evacuation Reason:

○ Unknown

○ Emergency worker or public official ordered, precautionary

○ Threat to the public

○ Company policy

6. Elapsed time until area was made safe:

/ 0 / 1 / hr. / 0 / 0 / min.

7. Telephone Report

/ 7 / 7 / 5 / 6 / 1 / 3 / NRC Report Number / 1 / 0 / month / 1 / 1 / day / 0 / 5 / year

8. a. Estimated pressure at point and time of incident:

10 *PSIG*

b. Max. allowable operating pressure *(MAOP)*: 0.5 *PSIG*

c. MAOP established by:

○ Test Pressure _____ psig

● 49 CFR § 192. 619 (a)(3)

PART B – PREPARER AND AUTHORIZED SIGNATURE

William Burnett / Supervising Engineer
(type or print) Preparer's Name and Title

573-681-7151
Area Code and Telephone Number

wburnett@ameren.com
Preparer's E-mail Address

573-681-7510
Area Code and Facsimile Number

William Burnett
Authorized Signature

William Burnett / Supervising Engineer
(type or print) Name and Title

11/08/05
Date

573-681-7151
Area Code and Telephone Number

PART C – ORIGIN OF THE INCIDENT

1. Incident occurred on
   - ○ Main ○ Meter Set
   - ○ Service Line ● Other: Low Pressure System
   - ○ Pressure Limiting and Regulating Facility
2. Failure occurred on
   - ○ Body of pipe ○ Pipe Seam
   - ○ Joint ○ Component
   - ○ Other: _____
3. Material involved *(pipe, fitting, or other component)*
   - ○ Steel
   - ○ Cast/Wrought Iron
   - ○ Polyethelene Plastic (complete all items that apply in a-c)
   - ○ Other Plastic (complete all items that apply in a-c)
     Plastic failure was: ☐ a.ductile ☐ b.brittle ☐ c.joint failure
   - ○ Other material: _____
4. Year the pipe or component which failed was installed: / / / / /

PART D – MATERIAL SPECIFICATION (if applicable)

1. Nominal pipe size *(NPS)* / / / / / in.
2. Wall thickness / / / / / in.
3. Specification _____ SMYS / / / / / / /
4. Seam type _____
5. Valve type _____
6. Pipe or valve manufactured by _____ in year / / / / /

PART E – ENVIRONMENT

1. Area of incident
   - ○ Under pavement ○ In open ditch
   - ○ Under ground ○ Above ground
   - ○ Inside/under building ○ Under water
   - ○ Other: _____
2. Depth of cover: _____ inches

PART F – APPARENT CAUSE

Important: There are 25 numbered causes in this section. Check the box to the left of the primary cause of the incident. Check one circle in each of the supplemental items to the right of or below the cause you indicate. See the instructions for this form for guidance.

F1 – CORROSION

If either F1 (1) External Corrosion, or F1 (2) Internal Corrosion is checked, complete all subparts a – e.

1. ☐ External Corrosion
2. ☐ Internal Corrosion

a. Pipe Coating
- ○ Bare
- ○ Coated
- ○ Unknown

b. Visual Examination
- ○ Localized Pitting
- ○ General Corrosion
- ○ Other: _____

c. Cause of Corrosion
- ○ Galvanic ○ Stray Current
- ○ Improper Cathodic Protection
- ○ Microbiological
- ○ Other: _____

d. Was corroded part of pipeline considered to be under cathodic protection prior to discovering incident?
○ No ○ Yes ○ Unknown Year Protection Started: / / / / /

e. Was pipe previously damaged in the area of corrosion?
○ No ○ Yes ○ Unknown How long prior to incident: / / / years / / months

F2 – NATURAL FORCES

3. ☐ Earth Movement ⇒ ○ Earthquake ○ Subsidence ○ Landslide ○ Other: _____
4. ☐ Lightning
5. ☐ Heavy Rains/Floods ⇒ ○ Washouts ○ Flotation ○ Mudslide ○ Scouring ○ Other: _____
6. ☐ Temperature ⇒ ○ Thermal stress ○ Frost heave ○ Frozen components ○ Other: _____
7. ☐ High Winds

F3 - EXCAVATION

8. ☐ Operator Excavation Damage *(including their contractors)* / Not Third Party
9. ☐ Third Party Excavation Damage *(complete a-d)*
   a. Excavator group
   ○ General Public ○ Government ○ Excavator other than Operator/subcontractor
   b. Type: ○ Road Work ○ Pipeline ○ Water ○ Electric ○ Sewer ○ Phone/Cable/Fiber ○ Landowner ○ Railroad ○ Building Construction ○ Other: _____
   c. Did operator get prior notification of excavation activity?
   ○ No ○ Yes: Date received: / / mo. / / day / / yr.
   Notification received from: ○ One Call System ○ Excavator ○ General Contractor ○ Landowner
   d. Was pipeline marked?
   ○ No ○ Yes *(If Yes, check applicable items i – iv)*
   i. Temporary markings: ○ Flags ○ Stakes ○ Paint
   ii. Permanent markings: ○ Yes ○ No
   iii. Marks were *(check one)* ○ Accurate ○ Not Accurate
   iv. Were marks made within required time? ○ Yes ○ No

F4 – OTHER OUTSIDE FORCE DAMAGE

10. ☐ Fire/Explosion as primary cause of failure ⇒ Fire/Explosion cause: ○ Man made ○ Natural *Describe in Part G*
11. ☐ Car, truck or other vehicle not relating to excavation activity damaging pipe
12. ☐ Rupture of Previously Damaged Pipe
13. ☐ Vandalism

F5 – MATERIAL OR WELDS

Material

14. ☐ Body of Pipe ⇒ O Dent O Gouge O Wrinkle Bend O Arc Burn O Other: _____
15. ☐ Component ⇒ O Valve O Fitting O Vessel O Extruded Outlet O Other: _____
16. ☐ Joint ⇒ O Gasket O O-Ring O Threads O Fusion O Other: _____

Weld

17. ☐ Butt ⇒ O Pipe O Fabrication O Other: _____
18. ☐ Fillet ⇒ O Branch O Hot Tap O Fitting O Repair Sleeve O Other: _____
19. ☐ Pipe Seam ⇒ O LF ERW O DSAW O Seamless O Flash Weld
O HF ERW O SAW O Spiral O Other: _____

*Complete a-f if you indicate **any** cause in part F5.*

a. Type of failure:

☐ Construction Defect ⇒ O Poor Workmanship O Procedure not followed O Poor Construction Procedures

☐ Material Defect

b. Was failure due to pipe damage sustained in transportation to the construction or fabrication site? O Yes O No

c. Was part which leaked pressure tested before incident occurred? O Yes, *complete d-f, **if known*** O No

d. Date of test: / / / mo. / / / day / / / yr.

e. Time held at test pressure: / / / hr.

f. Estimated test pressure at point of incident: _____ *PSIG*

F6 – EQUIPMENT OR OPERATIONS

20. ☐ Malfunction of Control/Relief Equipment ⇒ O Valve O Instrumentation O Pressure Regulator O Other: _____
21. ☐ Threads Stripped, Broken Pipe Coupling ⇒ O Nipples O Valve Threads O Mechanical Couplings O Other: _____
22. ☐ Leaking Seals

23. ☒ Incorrect Operation

a. Type: ● Inadequate Procedures O Inadequate Safety Practices O Failure to Follow Procedures O Other: _____

b. Number of employees involved in incident who failed post-incident drug test: / / / 0 / Alcohol test: / / / / /

c. Was person involved in incident qualified per OQ rule? ● Yes O No d. Hours on duty for person involved: / 0 / 4 /

F7 – OTHER

24. ☐ Miscellaneous, *describe:* _____
25. ☐ Unknown

O Investigation Complete O Still Under Investigation *(submit a supplemental report when investigation is complete)*

PART G – NARRATIVE DESCRIPTION OF FACTORS CONTRIBUTING TO THE EVENT *(Attach additional sheets as necessary)*

See attached document

PART G – NARRATIVE DESCRIPTION OF FACTORS CONTRIBUTING TO THE EVENT

Pre-incident information: A cast iron replacement project was underway which involved replacing various sizes of low pressure (inches of water column) cast iron mains and steel services, and converting all of these new facilities and some existing low pressure polyethylene mains and services to an operating pressure of 10 psig.

The AmerenUE contractor completed the first phase of the project by replacing the existing cast iron mains and steel services. The second phase of the project involved converting a low pressure area which had existing polyethylene mains and services to 10 psig. The existing polyethylene mains and services had an established MAOP of 60 psig. This required separating a section of the existing polyethylene mains from the low pressure system, adding regulators to each meter location in the section, and connecting the section to an adjacent 10 psig gas source. The section to be converted was sized to allow for the completion of work by the AmerenUE contractor within a single day to minimize gas service interruption.

Incident Information: The contractor began the morning by performing work to isolate the system to be converted to 10 psig from the low pressure system. During this time additional contractor crew members went to each of the thirteen meter locations designated by AmerenUE as part of the conversion to shut off service and to remove the meter from the inlet piping. An AmerenUE inspector was witnessing this activity and checked each service off of a list once the work was completed.

The contractor completed the work to isolate the system at approximately 11:00 a.m. The AmerenUE Supervisor, AmerenUE Inspector, and the contractor Foreman met again at approximately 11:30 a.m. to review the work completed to this point and to review the plans to make sure everything was ready for the introduction of 10 psig into the system. They reviewed the construction prints and discussed the main separation locations, tie-in locations, and the thirteen service locations that were separated. All were in agreement that they were ready to proceed with the next step of introducing 10 psig into the system.

At approximately 11:35 a.m., a valve was opened to introduce 10 psig into the system. At approximately 11:53 a.m., the AmerenUE Supervisor overheard the AmerenUE Dispatcher calling an AmerenUE Serviceman to respond to a gas pressure problem at a restaurant at 415 Ashley Road in Boonville. The AmerenUE Supervisor recognized the restaurant was located on the low pressure system just north of the area that was being converted to 10 psig. He suspected there must be a problem resulting from the system conversion so he called the AmerenUE Inspector and instructed him to close the valve that was previously opened. The Inspector had left the job site to obtain additional materials so he contacted the contractor by cell phone and instructed the contractor to immediately close the valve. The AmerenUE Supervisor returned to the job site and instructed the contractor to open meter service valves in the area and cut a cap off of an exposed polyethylene main to relieve the 10 psig of pressure from the system.

The AmerenUE Supervisor contacted the AmerenUE Superintendent, Engineering and Operations and notified him of the situation at approximately 12:10 p.m. The Superintendent instructed the AmerenUE Supervisor to send AmerenUE gas personnel to the low pressure regulator stations to bleed the pressure off of the low pressure system that was affected. It was determined that the low pressure system was pressurized to 10 psig so the Superintendent instructed the Supervisor to shut down and isolate the entire low pressure system.

The Superintendent arrived at Boonville at approximately 12:50 p.m. At that time the affected low pressure system was depressurizing and was at a pressure of 0 – 1 psig.

At approximately 1:30 p.m. AmerenUE gas personnel began shutting off the meters that served the low pressure system that was isolated. Additional AmerenUE gas personnel from other locations were called to assist. There were approximately 750 customers affected by isolating the low pressure system.

AmerenUE investigated and discussed the situation to determine the cause of the over pressurization. It was identified that a 4" main connecting the low pressure system and the system to be converted to 10 psig was overlooked and was not separated prior to introducing the 10 psig. This allowed the 10 psig to flow into the low pressure system, which is supplied by regulator stations that are in a monitor configuration, causing the system over pressurization.

APPENDIX D

(AmerenUE Press Release)

AmerenUE News Release

Ameren Services
101 Madison/P.O. Box 780
Jefferson City, MO 65102

Contact:

Mike Cleary
(573) 681-7137

For Immediate Release

AmerenUE Reports Progress in Restoring Boonville Natural Gas Service; Urges Residents Still Without Gas to Call AmerenUE

Boonville, Mo., Oct. 12, 2005—AmerenUE reports it has restored natural gas service to all but about 125 of the nearly 1,000 Boonville customers who lost gas service Monday. AmerenUE had shut off service to about 700 of those customers when gas at intermediate pressure flowed into a portion of the community's natural gas system that is designed to operate at lower pressure. Additional customers shut off their own gas as a precaution when the incident occurred.

AmerenUE crews will continue restoring gas service until service is restored to all premises where it is safe to do so. To help make sure the remaining customers get gas restored as quickly as possible, **customers who are still without gas service are urged to call AmerenUE at 1-800-552-7583.**

# # #